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PHENOMENA AND DEVELOPMENT OF FECUNDATION.[1]

BY H. J. WEBBER.

NECESSITY OF REPRODUCTION.

The necessity for animals and plants to have some means of reproducing themselves is clearly evident. Every organism has what we may term a normal length of life, which as Weismann has shown, is probably determined by the environment of the species, having been gradually developed by natural selection. If then, after a certain period, organisms die, species would become extinct unless means are provided for their perpetuation.

Of certain organisms, however, we cannot predicate that death will occur. On the contrary, for the Protozoa and probably Protophyta, (unicellular organisms,) it has been determined by investigation that there is no normal length of life and consequently following, death. They are according to Weismann, immortal, so far as normal death is concerned. Nevertheless here also is a necessity for reproduction. Accidental death must be considered and the ravages from higher animals to which the Protozoa and Protophyta are exposed, are enormous. Sothro ughout animals and plants, without exception, methods are provided for the reproduction of the species.

[1] A lecture delivered December 16, 1891, before a meeting of the Alumni Association of the St. Louis Medical College.

The first and simplest reproduction is a simple, almost mechanical fission or breaking apart of a naked mass of protoplasm, which is nevertheless an organized being, as seen in the fission of the swarm spores of Myxomycetes, in other Protozoa and Protophyta. The body of the organism, after a lengthened period of growth, reaches a size where the proportion of the surface to the bulk is not sufficient to provide suitable nourishment for its continued growth. Thus a division or multiplication of the body is necessitated to provide greater surface for absorption.

In a thorough consideration of these facts, we come to see how intimately growth and reproduction are associated, growth being nothing more than a protoplasmic and usually cellular reproduction. We are very apt to think of cell division as a necessary accompaniment of growth. But this is not so. Growth is independent of cell multiplication. Cell division need not take place during growth, but may appear only after its conclusion. In *Stypocaulon*, an alga belonging to the Phæosporeæ the lateral branches of the frond, as pointed out by Geyler, attain their full size before the formation of cells begins. Cells are then formed from the base upward, until finally the branch, which was a single cell, becomes a normal multicellular organ. One of the most remarkable cases illustrating this point is found in Caulerpa, a seaweed, the whole vegetative body of which remains throughout life an enormous single cell. (Fig. 1, a portion of frond, natural size). In the cavity of this thick walled vescicle, however, numerous cross bars of cellulose are found to give greater strength. In the common green felt (Vaucheria) even these cross bars are wanting. Cell division, however, usually accompanies growth and as shown above is in most cases a necessity to provide sufficient nutrition.

CELL REPRODUCTION.

The phenomena of cell reproduction or division are so intimately connected with the consideration of all phenomena of reproduction and fecundation that it is necessary for us to briefly consider this subject as a preparatory step. The changes which take place in the cell nucleus seem to be of paramount

importance in cell division. Since Robert Brown, in 1833, first discovered the cell nucleus in the generative organs of orchids, and Von Mohl in 1835 first saw it divide, it has been growing in importance until now, or at least not long ago, the majority of biologists were willing to assign to it all importance in reproduction and in the life of the cell, the cell brain as it were.

Amitosis.—We need only to consider the so called *indirect, mitotic* or *karyokinetic* division. The *direct* or *amitotic* nuclear division it appears from Flemming's[1] late paper and Ziegler's[2] biological discussion of *amitotic* nuclear division, having merely a nutritive or secretory function, occurs in the animal kingdom only at the end of typical cell multiplication, when the cell is given over to other purposes and loses its power of physiological multiplication and reproduction of cells. Amitotic nuclear division then always indicates the end of the series of divisions. Ziegler thinks "it occurs chiefly (perhaps exclusively) in such nuclei as minister to a process of unusually active secretion or assimilation." In typical gland cells it is frequently found. Whether like conclusion will be reached in the vegetable kingdom is yet doubtful, but in the absence of definite investigations we are justified in assuming that similar limitations may be drawn, and that in our consideration of reproduction we need not further discuss this kind of cell division.

Karyokenesis.—In the cell nucleus, two kinds of protoplasm may be distinguished, the *chromatin*, so named from its strong affinity for stains, and the achromatin. Other substances have, it is claimed, been differentiated, but these will for the present answer our purpose. Investigators have come almost uniformly to agree that the essential features of karyokenesis lies in the equal distribution of the chromatin elements to the daughter cells.

The resting nucleus (fig. 2) presents under the microscope a finely punctate character but close examination will show us that these granules (*microsomata*) are connected by fine granu-

[1]W. Flemming, "Ueber Teilung und Kernformen bei Leukocyten und über deren Attraktionssphären." Archiv. f. mikr. Anatomie, 37 Bd. 1891.

[2]H. E. Ziegler, "Die biologische Bedeutung der amitotischen (direct) Kernteilung im Tierreich." Biol. Centralblatt, Bd. XI, pp. 372-389, July 1891.

lar threads, and that these, winding up and down here and there in the nucleus, form the so-called reticulum of the nuclear protoplasm. It is in reality then a complexly coiled, possibly continuous thread composing the chromatin matter of the nucleus, coiled in the clear achromatin and surrounded by the nuclear membrane. The first indication of division is an increase in the size of the nucleus. The reticulum gradually contracts until the nucleus, presents a coarsly granular appearance. This contracting continues. The protoplasm begins to collect at the ends of the nucleus which will be the poles of the future nuclear spindle. The contracted chromatin thread becomes apparently homogeneous and finally breaks up into an even number of segments which are distributed in a more or less definite manner at the equator of the nuclear spindle which has made its appearance in the protoplasm during the above changes (figs. 3–4). Each segment now divides into two, splitting longitudinally, making twice the original number, and these, yielding to an apparent attraction from the poles of the dividing nucleus, gradually separate in a definite manner and pull away from the equator toward the poles, following the lines of the delicate nuclear spindle. As they approach their respective poles the daughter segments draw closer and closer together until their upper ends meet and fuse (figs. 5–6). The lower ends then bend inward and also apparently fuse forming a continuous coil (figs. 6–7); while the daughter segments move towards the poles, the spindle fibres remain behind, and others become intercalated and a bulging out occurs, forming ultimately a barrel shaped structure. Soon in the equatorial region slight thickenings form on the spindle fibers (figs. 7–8). These become more and more marked and gradually touch and fuse, forming the new cell-wall between the now divided daughter nuclei (fig. 9).

During the process of cell-wall formation, the segments of the daughter nuclei which have united as above explained, begin to elongate and decrease in thickness, taking on the appearance of the resting nucleus. The remaining steps are just the reverse of those preparatory to division. The filament

elongates and decreases in thickness until it comes again to present the appearance of a resting nucleus.

The above outline of the general course of cell division, in main taken from Strasburger, represents the view of cell division in the vegetable kingdom that has been recognized until very lately.

Karyokinesis in the Animal Cell.—In the division of the animal cell, the phenomena agree in all essential features. We have appearing here the two important bodies occupying the poles of the dividing nucleus, designated first by Fol as "*asters*" later by Van Beneden as "*attractive spheres*" and quite recently by Boveri as "*archoplasmic spheres.*"

The central area of the archoplasm (fig. 10, a.) is situated in the cytoplasm near the nuclear membrane, and from it, as a centre there radiate out in all directions the granular archoplasmic filaments or radiating striae of the asters, some directed toward the nucleus and penetrating into it. The center of the archoplasm is sometimes occupied by a definite body the so-called *centrosome.* The fundamental importance of the function of the archoplasm and its centrosome is yet rather doubtful. Van Beneden looks upon it as a permanent organ, equal in value to the nucleus itself. Guignard, as we shall shortly see, is inclined to assign to it paramount importance in cell division, as directing and guiding the distribution of the chromatin elements.

When we examine a daughter nucleus at the close of karyokinetic division, we see at one side of it the archoplasmic sphere in the position it occupied during the process of division. Shortly before a new division starts (or we may say as the first step in the next division) this archoplasmic sphere divides into two (fig. 11) and the two new archoplasmic spheres thus formed, pass around the nucleus in opposite directions until they come to occupy points on exactly opposite sides, when their effect is soon shown by the starting of the phenomenal changes of karyokinetic division. Thus it is seen as new nuclei arise by division, so also the new archoplasmic spheres arise in in the same manner.

Guignard's[1] *and Wildeman's*[2] *Recent Discoveries.*—It is not until very recently that anything similar to the asters or archoplasm has been discovered in the vegetable cell. This year Guignard, a careful observer, published his observations "On the Existence of Attractive Spheres in the Vegetable Cell" which, from present appearances, marks an epoch in the development of vegetable cytology.

In the resting nucleus, according to Guignard, two *attractive spheres* or *asters* are present. They lie close together at one side of the nucleus, (figs. 49, 54 and 56). Within each is a central corpuscle, the centrosome (figs. 12, a, 49, 54, etc.) surrounded by a transparent areole and around this a granular circle (fig. 12 b.). In general the radiating striae are invisible as long as the cell is in a state of repose (fig. 49). They become feebly apparent when the nucleus presents the first symptoms of entering upon division and at this time they withdraw from each other in order to place themselves at two opposite points corresponding to the poles of the future spindle (figs. 12 and 51). After this the striæ become more evident and direct themselves toward the nucleus, while it is still provided with a nuclear membrane, which confirms the opinion of Strasburger that the spindle originates outside the nucleus in the cytoplasm. When the chromatin segments have separated and collected at the poles, the centrosomes divide in each sphere into two new centrosomes, which thus have their origin at each pole (figs. 53 and 55). They remain in this position till the next nuclear division is preparing to start, when they separate as explained above.

"In resume," says Guignard, "the bodies in question, which merit the name of directive spheres since they govern the division of the nucleus, transmit themselves without discontinuity from one cell to the other throughout the life of the plant."

[1] Leon Guignard, "Sur l'Existence des 'Spheres Attractives' dans les Cellules Vegetales." Compt. Rend. Soc. de Biol. T.iii; p. 182. (March 20, 1891).—Ann. des Sci. Nat. Bot. T. xiv; No's. 3–4; pp. 163–288 (Nov. 1891), (10 pl.). Comptes rendus Acad. des Sci., 9 Mars 1891.

[2] E. De Wildeman, in Bull. Acad. Roy. Sci. Belgique, LXI (1891) pp. 594-602 (1 pl.)

It is interesting to note that very shortly after the appearance of Guignard's paper on attractive spheres, Wildeman (l. c.) published a paper on the same subject containing observations on Spirogyra and several Liverworts and Mosses which is entirely confirmatory of Guignard's discoveries, and Van Tieghem[1] has proposed the term "*directing leucites*" or *tinoleucites* for them, from their property of inciting and directing the binary division of nuclei.

CHARACTER OF THE SEXES.

Geddes and Thompson's Katabolic-Anabolic Theory of Male and Female.—In approaching a consideration of fecundation it is well for us to inquire into the characters of the sexes and as to what determines sex. Let us plunge immediately into a discussion of the theory which seems to us to be the best yet suggested. Geddes and Thompson in their excellent work on the "Evolution of Sex"[2] strongly support what we may term the *katabolic-anabolic* theory of male and female.

In the changes of protoplasm necessitated by the process of living, the upbuilding constructive series of chemical changes are known under the general term *anabolism*; while the disruptive descending series are known under the term *katabolism.* Now male and female differ according to this theory of Geddes and Thompson in their physiological habits; the female being fundamentally of an anabolic character, the male of katabolic character. According to this view males are stronger, handsomer, more active, etc., merely because they are males, that is, are of more active physiological habit,—more metabolic—disruptive changes tending to predominate in the sum of changes in the living matter. The females, on the other hand, live at a profit, are more anabolic,—constructive process predominate in their life; whence indeed their capacity of bearing offspring.

Haeckel in the introduction to his "History of Creation" remarks that the intrinsic value of an hypothesis or theory, depends upon the number of phenomena we can explain by its application. Judging this theory of sex by such a standard,

[1]Van Tieghem, Journ. de Bot. (Morot), V. (1891) pp. 101-102.

[2]Geddes and Thompson, "Evolution of Sex," London 1889.

and we come to realize its great worth, reaching to the very boundaries of sex in its application and being a chief element in the development of sex. Of the very numerous illustrations given by Geddes and Thompson, we can only select a very few.

The female cochineal insect, laden with reserve products spends most of her time on the cactus plant as a mere quiescent gall, while the male, on the contrary, is provided with wings, agile, restless and short lived. Almost innumerable instances of a similar character might be cited. Up to the level of the amphibians the females are generally larger. A sluggish conservative habit of body tends to an increase of size. Lavish expenditure of energy uses up the reverse material and keeps down the size. The large and small spores (macrospores and microspores) which we find in plants, and which mark the beginning of sex, illustrate the same law. Of sex cells in general, all are familiar with the fact that the antherozoids and spermatozoids are always much smaller and infinitely more active than the female cells. The agility of males it appears then is not a special adaptation as Darwin suggested to enable them to better and more surely perform their functions with relation to the other sex, but is a natural characteristic of the constitutional activity of males.

Body temperature which is an index to the pitch of life is distinctly lower in females as observed in the human species, insects and plants.

A familiar and striking illustration of this law is found in the process of menstruation, if it has been rightly interpreted. You are likely, as physicians, more familiar with the various theories of menstruation than I. Probably the most generally accepted one is "that which regards the growth of the mucus coat before fecundation as a preparation for the reception of an ovum if duly fertilized, and the menstruation process itself as the expression of the failure of these preparations." If we express it now in terms of the anabolic-katabolic law, or the anabolic highly vegetative character of the female, menstruation is the means of getting rid of the anabolic surplus in case it is not consumed as intended in the growth and development

of the forming embryo. If fertilization be accomplished we should expect no menstrual flow and so indeed it is,—we have none; the, as it were, parasitic embryo using up the surplus. So also during lactation, while the offspring is still supported by the mother, menstruation does not usually occur, and here also from this theory of sex and of the anabolic female we should not expect it to occur, the surplus being taken up in the support of the offspring. At the close of lactation, menstruation begins again, as we should further expect.

A very different yet similar case is found in the secretion of nectar in flowers. The distinctive anabolic flow continues until fecundation is accomplished, after which it ceases and the surplus passes into the forming seed.

The katabolic-anabolic law seems also to have fundamental importance in determining the sex of a developing embryo. Some experiments conducted by Young, on tadpoles, are very interesting and instructive as bearing on this problem.

Tadpoles pass through a hermaphrodite stage, in common, according to other authors, with most animals. During this phase external influences and especially food decide their fate as regards sex, though hermaphroditism sometimes persists in adult life. When tadpoles were left to themselves, the percentage of females was rather in the majority, the average number being about 57 in a hundred. In the first brood, by feeding with beef, Young raised the percentage of females from 57 to 78: in the second with fish, the percentage raised from 61 to 81; while in the third set when the especially nutritious flesh of frogs was supplied, the percentage rose from 56 to 92. That is to say in the last case, the result of high feeding was that there were 92 females to 8 males. These results coming from such an investigator, emphasizing the anabolic character of the female, are surely very suggestive.

Meehan's observation that old branches of conifers overgrown and shaded by younger ones produce only male inflorescence; and those of various botanists that prothallia of ferns grown in unfavorable conditions produce only antheridia and no archegonia or female organs are further illustrations of the same law and its bearing on the determination of sex.

(*To be continued.*)

NOTES UPON THE ANATOMY AND HISTOLOGY OF THE PROSENCEPHALON OF TELEOSTS.

By C. L. Herrick.

Our knowledge of the microscopic structure of the cerebrum of bony fishes is very imperfect, and I shall endeavor to show that, notwithstanding the great progress recently made in determining the difficult homologies involved, gross misconceptions pass current at the present time. The fundamental difficulty lies in the fact that the cortex is anatomically absent though morphologically present. In other words, though there is no functionally normal cortex, its place is taken by an epitheligerous membrane which in all important morphological particulars substitutes for it. It is quite a different question whether the cortex is physiologically represented; i. e., whether cellular structures exist which functionally replace the undeveloped cortical areas. This may rank among the most important question of physiology as it undoubtedly is of morphology. Inasmuch as the cortex of higher vertebrates serves solely as the organ of consciousness in the limited sense, if it could be shown that it is not only anatomically absent, but physiologically unrepresented, we should have strong reason to suppose that consciousness is practically absent in the group of fishes and thus is an unnecessary element in a purely animal existence even of a relatively highly differentiated organism.

On the other hand, if it could be shown that some other cell aggregate functions in place of the suppressed cortex, it might be hoped that in locating the substituting areas we should obtain the clue to the origin of the cortex and the law of development or, rather, the archetectonic plan of formation. In the latter respect we have secured so much concurrent evidence from widely different sources that the case seems comparatively clear.

If the fish brain, in spite of its great dissimilarity to the brains of higher vertebrates is actually homologous with the latter in detail, it should be possible to discover the exact

homologies of the separate organs, or determine the absence of certain parts, together with the morphological reasons for their suppression. In this direction nothing was possible before the pallium had been identified with the cortex and the homologies of the ventricles had been determined in conformity therewith. Even since this has been accomplished many homologies remained uncertain which were essential to a proper understanding of the evolution of the brain of higher vertebrates. None of these homologies are more important than those which relate to the commissures which may naturally be taken as the points of reference. In this last mentioned direction a study of the Drum (*Haplodinotus*) has fortunately afforded the necessary clues.

What follows is a brief summary of a detailed paper to appear in the December number of the *Journal of Comparative Neurology*, forming part of a series which has appeared in several previous issues. The methods pursued will be given in full in connection with the paper, so that it is only necessary to say that a modification of the hæmatoxylin process has been hit upon, which serves to sharply differentiate all the histological elements, bringing out the variations in cell-structure beautifully. In fact a fish brain thus treated is histologically, instead of the least satisfactory, rather the most beautiful of brain preparations. A large series of sections has been secured from which a few of the more important data are here noted.

First, in respect to histological differentiation within the cerebrum. If the axial lobe of the fish cerebrum represents functionally the entire brain, as would seem probable unless one claims that the fish leads a purely reflex nervous existence, that there should occur in it the various types of cells which characterize the several regions of the cortex in higher animals. The writer has abundantly shown in a series of publications covering most of the classes of vertebrates that there is a structural difference between the kinesodic and æsthesodic areas of the cortex and that the motor and sensory cells are more distinctly aggregated in lower than in higher vertebrates. In other words, that types of cells, which in higher animals are interblended, are quite distinctly seggregated into definite

areas in lower groups. Thus we have shown that in rodents and marsupials the motor and sensory cells are more distinct and topographically separable than in higher animals, that in reptiles they are much more sharply limited than in mammals and that in fishes the distinction is still sharper. Mr. Turner, who at our suggestion investigated the same question in birds, has found a close resemblance to the reptilian type and fully corroborates the statement that complete structural dissimilarity between kinesodic and æsthesodic cells prevail in the Monocondylia. Whether we regard the brain of a fish as the result of a retrograde metamorphosis from a more typical structure, or as representing a primitive condition, it will be conceded that the cells corresponding to kinesodic and æsthesodic processes must be in all probability represented. The absence of the cortex limits our search to the axial lobe. Observations upon various groups of reptiles have led me on several different occasions to suggest that the axial lobe, seen in those groups where the cortex is present, is a sort of proliferating centre from which cortical cells are formed. [1]

This hypothesis has been further substantiated by the observations of Mr. Turner,[2] upon the axial lobe of various birds. It is also worthy of note that the birds resemble fishes in the great restriction of the cortex and in specific substitutions therefore in the form of niduli within the axial lobe. It would, therefore, appear legitimate to consider the axial lobe as the source from which the cortex has sprung, so far as its histological elements are concerned, a suggestion which is further emphasized by the fact, brought out by Professor His and extended by the writer, that all neural elements are derived from the epithelial structures lining the ventricle.

A corollary of this would be the concentration of all commissures and tracts belonging strictly to the cortex in the axial lobe. The position of such structures might then serve to determine the direction in which the complicated brain of

[1] Notes on the Brain of the Alligator. Journ. Cincinnati Society of Natural History, vol. XII, p. 455; Contributions to the Comparative Morphology of the Central Nervous System, II. Morphology and Histology of the Brain of certain Reptiles, *Journal of Comparative Neurology*, vol. I. p. 21, March 1891.

[2] *Journ. Comp. Neurology. Vol. 1, p. 71.*

higher vertebrates has been folded and differentiated. This principle the writer has employed in the determination of the histogenesis of the cerebellum. (Compare a recent article on the cerebellum in "*Science*.") Now to return to the special subject of our study, the cerebrum of the Drum is moderately large and well differentiated. The pallium is well developed and completely devoid of nerve cells, but the surface of the cerebrum is nevertheless quite conspicuously fissured. It was shown by my brother and myself in a series of articles in the *Journal of Comparative Neurology* for June and October, that the cerebrum of teleosts is more or less constantly marked by fissures which cannot be homologized, except in two cases, with the fissures of higher vertebrates, because of their lying in the surface of the axial lobe rather than the cortex. Nevertheless, these fissures serve to constantly delimit certain areas of the axial lobe, which are also remarkably constant in their histological differentiation. Using these land marks it has proven possible to define a number of distinct lobes, which have received names suggestive of their position. The homologue of the hippocampus, however, is easily recognized, not only by its position, but by reason of the anatomical connections. It forms a raised lip or projection along the ventral surface and is lateral of a fissure perfectly homologous of the rhinalis of higher animals. The forward prolongation may be compared to the convexity in the corresponding region of the pyriform lobe of rodents. Caudad it expands into an obpyriform lobe which is the hippocampus in a restricted sense. Throughout its entire extent, the hippocampal lobe is the part which mediates between the pallium (cortex) and the axial lobe, and is therefore identical in position with the outer part of the hippocampus of mammals. In microscopic structure it differs from the adjacent regions. The radix lateralis, which, as we have shown in the series of articles above referred to, is wholly distinct from the radix mesalis, follows the rhinalis fissure and may be traced in a single horizontal section to the caudo-ventral aspect of the hippocampus, where the fibres spread out upon the surface in a way entirely similar to that observed in rodents. The resemblance to the homologous organ of higher vertebrates does not

cease here, but from the deeper parts of the hippocampal lobe an ental tract, corresponding to the hippocampal commissure and descending fornix tract, arises and passes cephalomesad to cross just caudad of the strongly developed callosum. At this point a branch is given off precisely like the fornix which passes to a bilobed cellular mass, projecting ventrad into the ventricle caudad and dorsal of the lamina terminalis. In appearance and structure, as well as fibrous connections, these tubers can only be regarded as identical with the corpus fornicis. Nothing is wanting to make the homology perfect. Fibres from the fornix body can be traced into the thalamus, but nothing indentifiable with the mammillaries could be made out with certainty.

The radix mesalis of the olfactory is much larger and more distinct, and seems to be derived from a mass of cells occupying the pes, while the radix lateralis springs from the pero. This bundle passes caudo-dorsad and then mesad and crosses in a special ventral portion of the præcommissura quite distinct from the specific homologue of the latter. In the Drum, the olfactories are attached to the cerebrum, or more strictly, to the præthalamus just at the origin of the lamina terminalis. They are obviously not appendages of the prosencephalon, as we have suggested on morphological grounds it would be impossible for them to be, but the radices have suffered division or latero-flexion with the outgrowth of the secondary cerebral vesicles. The origin of the hippocampal loop of the olfactory tract becomes obvious by inspection of an embryonic brain or that of a fish, it being the least diverted portion of the walls of the primitive prosencephalic ventricle carrying with it the tracts and commissural origins proper to it. It is a curious fact that of the two radices of the olfactory, one belongs to the dorsal and the other to the ventral system and the commissural or decussational fibres likewise belong, one to the ventral the other to the dorsal of the two primary commissural systems of the neural tube. The radix lateralis connects, via hippocampus, with the dorsal system associated with the callosum, *i. e.* the fornix and hippocampal commissure. The radix mesalis, on the other hand connects with the anterior commissure sys-

tem. It would thus appear that the olfactory system, including the pes, is homodynamous with a complete neuromere or symmetrical fraction thereof.

The corpus callosum has been so much studied of late that it would be an act of presumption to put forth a new theory without the amplest evidence. In the present case the writer, in presenting an interpretation entirely different from the prevailing one, does so with the perfect confidence that any one who will examine the facts exhibited in our sections will be convinced of the correctness of the view. In a previous paper[1] the writer has indicated the existence of a hitherto unsuspected commissure in *Lepidosteus* and identified it as the homologue of the callosum hippocampal commissure in the following words:

" *Commissures of the Cerebrum.*—The exact equivalence of the commissures of the cerebrum is a matter of much difficulty in these fishes where the whole dorsal and median portion of the tectum cerebri or mantle portion is apparently represented by the pallium cerebri. Considering, however, that the direction in which the cerebrum has been differentiated in higher animals is caudad, and that, in the lower brains, bodies which lie caudad or dorsad in higher vertebrates must be sought dorsad or cephalad, it is not difficult to homologize the pallium with the plexus-bearing projection from the posterior and mesal margin of the mantle. Since the plexus in this case occupies the vertex, instead of projecting from the caudal region, all structures morphologically cephalad of the plexus must be sought still further cephalad or ventrad. Using this clue, and observing that the cerebral cortex folds ventrad over the olfactory structure, we think we find a homologue of the calloso-hippocampal commissure connecting the two halves of the cerebrum cephalad of the openings of the olfactory crura into the common ventricle, and lying just entad of the membranous lamina terminalis. The bundle is very small and seems to contain a few fibres from the olfactory regions, as well as

[1] Topography and Histology of the Brain of certain Ganoid Fishes, Journ. Comp. Neurology, vol. I., p. 167–168.

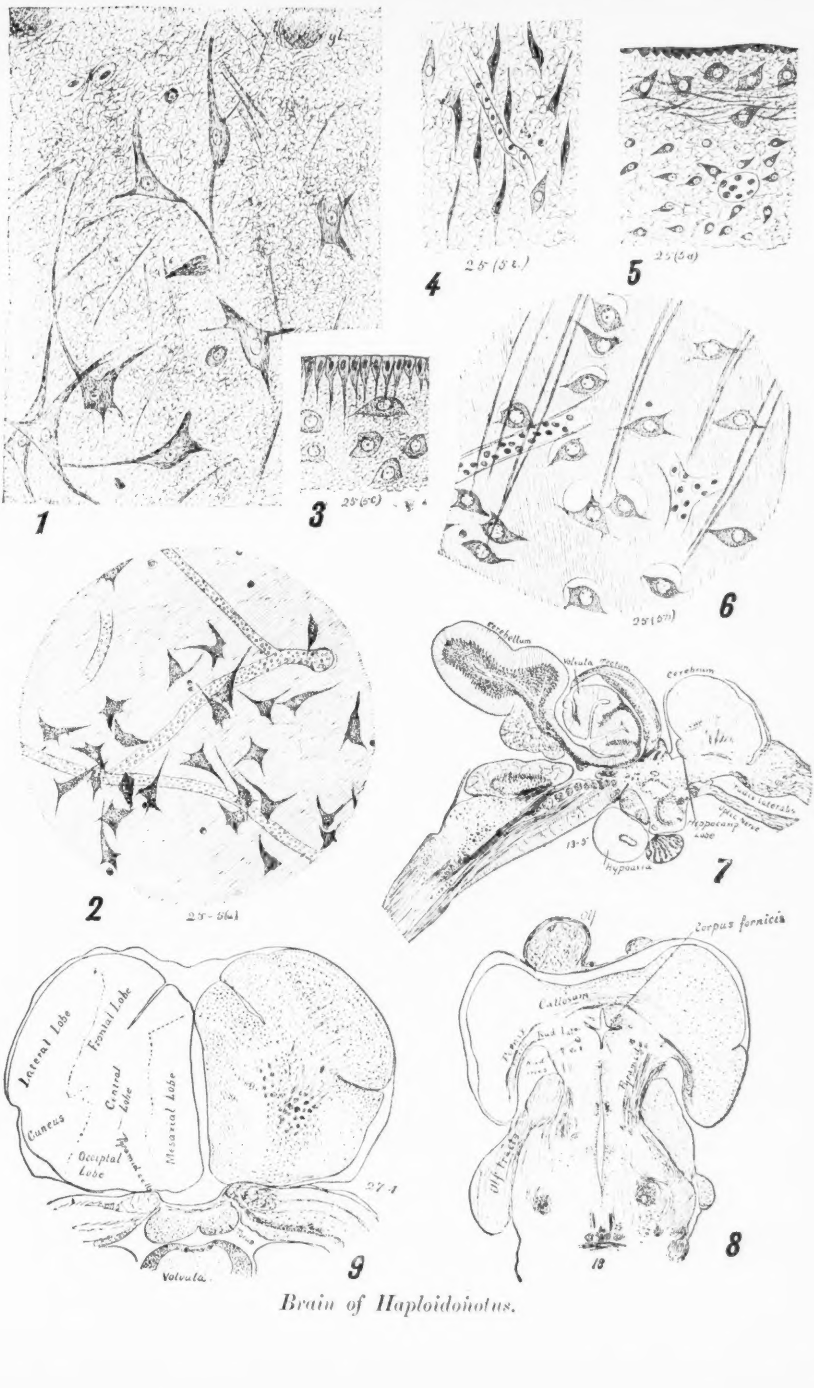
others from the cephalic portions of the cerebrum. No indication of the callosum was seen in Scaphirynchus."

In the Drum, however, the callosum is relatively large and conspicuous. It lies far cephalad and somewhat ventrad (morphologically dorso-cephalad) of the anterior commissure. It is directly associated with a large nidulus of pyramidal cells, which occupies a central position in the axial lobe in the direct line of the pyramid fibres produced. This central lobe is the unmistakable homologue of the motor areas occupying the cephalic cortical regions of higher vertebrates, and is therefore properly associated with the callosum. The callosum lies dorsad of and adjacent to the line where the pallium adheres to the axial lobe. It is therefore just where it would be expected upon the hypothesis that the structures otherwise found in the cortex had been driven from the latter by its conversion into the pallium, or, better, had failed to grow out into the pallium when it was formed.

Remembering that the growth of the cerebrum has been largely dorso-caudad, such a retarding as here supposed would leave the callosum where we find it at the cephalic juncture of pallium and axial lobe. Since the interventricular cortical lobe is suppressed in teleosts, it follows that the callosum and anterior commissure, which are collocated by accident, rather than relationship in Reptilia and Amphibia, are here widely separated. These facts are entirely in agreement with the highly philosophical theory of the commissures proposed by Osborn, though in the present case, Osborn supposed (an opinion in which the writer at first shared) that the callosum of fishes is contained in the anterior commissure group. The considerations above mentioned show that in the absence of the mesal walls of the cortex a collocation the two commissural systems, except by great axial shortening of the brain, would be impossible.

As to the general question, whether it is proper to suppose that the cell structures normally found in the cortex are derived from the axial lobe and may be retained there by conversion of the cortex to a cell-less pallium, I refer, first, to the data of embryology; second, to my own observations upon young

PLATE VIII.



Brain of Haploidonotus.

reptilian brains; and, third, to the discovery made by my pupil, Mr. Turner, that in the brain of birds there are several introverted cortical niduli within the axial lobe, in regions where the cortex is restricted or aborted.

In general, then, it seems proper to regard the cerebrum as a product of a dorso-lateral pouch from the thalamus, carrying with it the commissural systems (dorsal and ventral) belonging to what may be called the præthalamic segment or neuromere. The hippocampal system may be regarded as representing a part of the dorsal commissure, the callosum a part of the ventral and perhaps part of the dorsal, while the anterior commissure is decidedly ventral.

At any rate the morphological relations in fishes are precisely as in higher vertebrates. The conclusions above indicated may be thus summarized.

1. Fishes have a distinct corpus callosum separated from and on the opposite side of the ventricle to the præcommissura.

2. Fishes have a distinct fornix and hippocampal commissure.

3. A well-marked fornix body is present in fishes having normal fibre connections.

4. There are distinct radices mesalis and lateralis in the ichthic olfactory lobe, the former crossing in the anterior commissure, the latter passing to a hippocampal lobe.

5. The hippocampus of fishes is a distinct lobe of the axial part of the cerebrum.

6. The axial lobe in fishes is composed not only of the elements proper to the corpus striatum or sauropsidian axial lobe but also contains rudiments of the sensory and motor niduli of the cortex.

7. The two types of cells are sharply differentiated.

EXPLANATION OF PLATES.

Plate VII.

Horizontal longitudinal sections through the entire brain of the drum, *Haplodinotus grunniens*.

Fig. 1. Section through the olfactory lobes and corpus fornicis. The radix lateralis is easily followed throughout its entire length from the lateral aspect of the pero to the hippocampus. The radix mesalis arises in the pes and, curving ventral and then dorsal, appears cephalo-ventrad of the axial commissure as a circular bundle.

Fig. 2. Section at the level of the axial commissure (decussation of the basal peduncular tracts of Edinger) and callosum.

Fig. 3. Section above the level of the præcommissure, the tracts of which are visible in the section.

Fig. 4. Section near the dorsal surface of the cerebrum. The figure illustrates the structure of volvula and cerebellum.

PLATE VIII.

Fig. 1. Portion of olfactory pero highly magnified.

Fig. 2. Pyramidal (kinesodic) cells from the central lobe of cerebrum.

Fig. 3. Superficial portion of lateral lobe to show epithelium. The æsthesodic cells are transversely cut.

Fig. 4. Cells from E in fig. 3 of the previous plate.

Fig. 5. Portion of the cuneus.

Fig. 6. Cells from the lateral lobe.

Fig. 7. Longitudinal section through the whole brain.

Fig. 8. Horizonal section through entire brain somewhat dorsad of fig. 3 of the preceding plate.

Fig. 9. Section just dorsad of the olfactory crus to show the relations of fornix tracts and callosum.

ON THE HABITS AND AFFINITIES OF THE NEW AUSTRALIAN MAMMAL, *NOTORYCTES TYPHLOPS.*

By E. D. Cope.

The description of this remarkable mammal by Professor Stirling, of the University of Adelaide, has appeared in the *Transactions of the Royal Society of South Australia*, 1891 (July), p. 154. The announcement of the discovery of this supposed new marsupial by Prof. Stirling in the English journals during the past season has excited much interest, and the full description now given will be carefully read. My own reading has led me to make certain reflections on the characters and affinities of the animal, which are herewith given. But I first copy the following account of its

HABITS

from Professor Stirling's paper:

"It appears that the first specimen was captured by Mr. Wm. Coulthard, manager of the Frew River Station and other Northern runs belonging to the Willowie Pastoral Company. Attracted by some peculiar tracks on reaching his camp one evening on the Finke River, while traversing the Idracowra Station with cattle, he followed them up and found the animal lying under a tussock of spinifex, or porcupine grass (*Triodia irritans*). Though he is an old bush hand, with all the watchful alertness and powers of observation usually acquired by those who live lives of difficulty and danger, this was the first and only specimen of the animal he ever saw. As previously stated, this found its way to the museum through the agency of Messrs. Benham and Molineaux. The three subsequently received shortly afterwards, as well as the last lot recently secured by Mr. Bishop during our journey through the country, were also found on the Idracowra Station. This is a large cattle-run, comprising several hundred square miles of country in the Southern part of the Northern Territory of South Aus-

tralia, which lies immediately to the West of the telegraph line between the Charlotte Waters and Alice Springs Stations. The great dry water-course of the Finke River, which runs from N. W. to S. E., bounds the run for some eighty miles on the North and North East. Its distance from Adelaide is, roughly speaking, a thousand miles. Flats and sandhills of red sand, more or less well covered with spinifex and acacias, constitute a large portion of the country, and the rainfall is inconsiderable. Curiously enough, all the specimens hitherto received by me have been found within a circumscribed area, four miles from the Idracowra Head Station, which is situated on the Finke water-course itself, and almost invariably among the sandhills. I have it, however, on very fair authority, that the animal has been seen on the Undoolya Station, which lies immediately South of the McDonnell Ranges, and that one also was found drowned after heavy rain at Tempe Downs, a station situated about 120 miles W. S. W. of Alice Springs. These points will sufficiently define its range, so far as is known at present. They do not appear to be very numerous. Very few of the white men in the district had ever seen it, even though constantly traveling, and not many of the natives whom I came across recognized the well-executed colored drawing I carried with me. It must be remembered, however, that I did not pass through the exact spot which so far appears to be its focus of distribution. Nor did a very considerable reward which I offered cause any specimens to be forthcoming between the first lot received, over two years ago, and that recently secured during my transcontinental trip. With few exceptions the animals have been captured by the aboriginals, who, with their phenomenal powers of tracking, follow up their traces until they are caught. For this reason they can only be found with certainty after rain, which sets the surface of the sand and enables it to retain tracks that would be immediately obliterated when it is dry and loose. Nor are they found except during warm weather. So that the short period of semi-tropical summer rains appears to be the favorable period for their capture. For this suitable combination of wet and warmth, Mr. Bishop had to wait three months

before he was able to get them, and in all cases they were found during the day time. Perpetual burrowing seems to be the characteristic feature of its life. Both Mr. Bishop and Mr. Benham, who have seen the animal in its native state, report that emerging from the sand it travels on the surface for a few feet, at a slowish pace, with a peculiar sinuous motion, the belly much flattened against the ground while it rests on the outside of its fore-paws, which are thus doubled in under it. It leaves behind it a peculiar sinuous triple track, the outer impressions more or less interrupted, being caused by the feet, and the central continuous line by the tail, which seems to be pressed down in the rear. Constantly on the look-out for its tracks, I was often deceived by those of numerous lizards, which are somewhat similar in these respects. It enters the sand obliquely and travels underground either for a few feet or for many yards, not apparently reaching a depth of more than two or three inches, for whilst underground its progress can often be detected by a slight cracking or moving of the surface over its position. In penetrating the soil, free use as a borer is made of the conical snout with its horny protecting shield, and the powerful scoop-like fore-claws are also early brought into play. As it disappears from sight, the hind limbs as well are used to throw the soil backward, which falls in again behind it as it goes, so that no permanent tunnel is left to mark its course. Again emerging at some distance, it travels for a few feet upon the surface, and then descends as before. I hear nothing of its making or occupying at any time permanent burrows. Both my informants lay great stress on the phenomenal rapidity with which it can burrow, as observed both in a state of nature and in captivity. In some notes sent me by Mr. Benham the following statement appears: 'Almost any of the men here (Idracowra) can tell you how one got away from me in the loose sand. I brought it home alive and began talking about how fast it could burrow, so Mr. Stokes wanted to see it. We took a spade and loosened the top soil near the house, and put it down. I kept my hand close to it until it was nearly out of sight, and then started scratching after it,

but it was too quick; so I took a shovel and began to dig after it, but could not get him.

" 'One of the men then came with another shovel, and also a lubra (aboriginal female) who scratched, but the three of us failed to get him.' Making all allowances for possible misdirected energies in this experiment, there is no doubt but that their burrowing powers are remarkable. Mr. Bishop, who knew of my approach, made great efforts to keep alive for me some of those he had captured, and placed them for safe keeping in buckets of sand, but in spite of all care and attention one only lived as long as four days. Night and day the sound of their ceaseless burrowing was to be heard. Acting on my advice, previously given, in consequence of an examination of the contents of the intestines of one of the earlier specimens, he supplied them with ants as food, but they ate none. They did, however, eat one 'witchety,' the native name of large white grubs, much relished by the blacks as an article of food, which are the larval forms of certain Longicorn beetles and Lepidoptera, and Mr. Benham informed me that one of his ate a piece of bread on one occasion, but it only lived a day. They thus appear to stand captivity very badly. On being handled they make no attempt to bite. No black fellow that I questioned had even seen the young, nor did they know any thing whatever of any nests or breeding places used by them. Their native name is 'oor-quamata,' the terminal 'r' of the first syllable being much rolled so as almost to convey the sound of an interpolated short 'i' between the 'r' and the 'q'; the accentuated syllable is strongly marked, the vowels having the same value as in 'quarrel.' Mr. Benham states that the natives have a superstitious dread of them, and applied to one the term 'kudoicka' which they translate as 'devil-devil;' but I could not get this confirmed by any of the blacks I saw. In fact the natives seem to know very little about them, and could give me no information whatever as to what their food was, or whether they got it above or under ground. With the material at my disposal I should be able definitely to settle this point, and indeed, in one of my first specimens, I did most certainly find the remains of ants and

some other insect debris in what remained of the intestines; but as the Editor of these Transactions urgently calls for the completion of this paper, I am reluctantly obliged to postpone to a future issue the result of further investigation on this and on other points." (Trans. Roy. Soc. South Australia, vol. xiv, Pt. I, 1891. p. 155).

Affinities.

The most superficial observer will be at once struck with the remarkable resemblance which evidently subsists between the genus Notoryctes and the Chrysochlorid Insectivora of South Africa. The question then presents itself, is this a case of adaptive resemblance, or is it an example of true affinity? The question to be decided early in the investigation is whether Notoryctes is truly a marsupial.

The evidence furnished by Prof. Stirling that this animal is marsupial, consists of the following characters. First; it has a posteriorly opening marsupial pouch. Second; it has two very small osseous nodules in the tendon of the external oblique muscles, close to their insertion on the anterior border of the pubic symphysis (p. 178). They are scarcely visible without a lens, and are consequently liable to be overlooked. Third; the angle of the lower jaw is inflected. On these characters it may be remarked; First; that the pouch contains no mammæ as in Marsupialia, indicating that the early parturition of that order does not exist. Second; that a fibro-cartilage connects the external oblique muscle with the pubis in Canis, which Huxley, (Anatomy of Vert. Animals, p. 355) says "appears to represent the marsupial bone or cartilage of the marsupials." Third; that the inflection of the angle of the mandible is not greater, (to judge from Prof. Stirling's figures), than that seen in some Glires (Haplodontia) and Insectivora. In fact, this region is much like that seen in the species of Chrysochloris, where the angle is produced and incurved.

In opposition to the view that Notoryctes is a marsupial may be cited the two objections just made to the first and second of the characters adduced by Stirling, which might however be overcome, if stronger marsupial characters could

be found in the brain and reproductive system. The brain has not been examined, but the external form of the skull indicates characters like those of Chrysochloris, including larger hemispheres than are usual in marsupials. As to the reproductive system, the penis is single, indicating an undivided vagina in the female, a character non-marsupial, or present only in a highly specialized family of the order. The penis is cloacal as it is in Chrysochloris, as described by Dobson (Monograph of the Insectivora p. 125). Returning to the skeleton, we have other Insectivorous characters, which are non-marsupial. First; the imperforate palate; Second; the presence of a patella; Third; the incisor teeth, which are neither diprotodont, nor polyprotodont, but in number $\frac{3}{3}$, normal in the placental Mammalia.

If we adopt the view that this genus is placental, we have the following additional points of resemblance to the Chrysochloridæ. First, the general shape and structure of the skull. Second, the shape of the scapula, where the inferior (posterior) spinous ridge represents the edge of the thickened border in Chrysochloris. Third, the presence of a heavy metacromion. Fourth, the slenderness of the clavicle. Fifth, the shape of the humerus, especially distally, where however the entepicondylar foramen is closed, while it is open in Chrysochloris (Dobson). Sixth, the shapes of the ulna and radius are much like those in Chrysochloris. Seventh, even the form and character of the anterior foot, where the resemblance is great, although obvious differences exist. Eighth, the general shape of the pelvis is similar, especially the horizontal position, with minute obturator foramen. The presence of a symphysis pubis, and a posterior articulation of the ischium with the sacrum are important differences. The symphysis exists however in various Insectivora and the ischiosacral articulation is present in many Edentata. There is not much resemblance in the forms of the tibia and fibula, but these two elements are distinct from each other in both forms. Ninth, the posterior foot resembles considerably that of Chrysochloris, with manifest differences; and is similarly related to the anterior foot in proportions, and in the number of its digits, five to four, both genera. Tenth, the dentition.

Here the characters are remarkably like those of Chrysochloris both in the number and detailed structure of the teeth. The anterior incisors are long in the latter, and in Notoryctes there is no heel to the inferior true molars, thus resembling the true genus Chrysochloris.[1]

Such an aggregate of resemblances to the Chrysochlorididæ signifies, it appears to me, zoological affinity. Whether Notoryctes will ultimately be found to enter the Marsupialia or not, it must be a descendant out of the same stock as that which gave origin to the Chrysochlorididæ. But I suspect that the brain, female generative organs, and fœtal characters will turn out to resemble those of Chrysochloris, as do its other characters, and in that case Notoryctes will enter the Insectivora. In this order it will form a special family, Notoryctidæ, characterized by the presence of a symphysis pubis; the coossification of the posterior part of the ischium with the sacrum, and perhaps by the coossification of the cervical vertebræ. Perhaps there should be added to these characters, the fusion of the sacral metapophysis into a continuous roof, and the ossification and fusion with the first rib of its hæmapophysis.

The tritubercular molars, the large caudal intecenntra, the cloacal penis, show Notoryctes to be a primitive type. As to resemblances to Monotremata, such as have been suggested by a recent author, none exist. On the contrary, the Notoryctidæ realize a desideration to mammalian phylogeny, viz: a form which connects the marsupial with the placental mammalia, although it is a specialized representative of this type. That the insectivora are the connectant forms among placentals has been long suspected and, that the connection is polyphyletic is suggested by Notoryctes, since the Creodonta are also candidates for this position, from the resemblance of some them to the Dasy-

[1] There are three genera of Chrysochlorididæ, which are distinguished by the following dental characters, already pointed out by authors (See Dobson l. c. p. 109).

Teeth 40;	lower molars without heel;	*Chrysochloris* Cuv.
Teeth 40;	lower molars with heel;	*Bematiscus* Cope.
Teeth 36;	lower molars with heel;	*Amblysomus* Pom.

Chrysochloris includes only the *C. aurea;* Bematiscus includes *C. villosa* and *C. trevelyanii;* and Amblysomus the *C. rutilans* and *C. obtusirostris*. All are South African.

uridæ. The structure of the pelvis approximates that of a number of the Edentata, as do apparently the inferior incisor teeth. The origin of the latter order has yet to be discovered.

The existence of a South African type of placental mammal in Australia need not greatly surprise us, since the fresh water fish *Gonorhynchus greyi* is common to both countries, and the ratite birds and pleurodire tortoises are found in both.

Explanation of Plates.

Copied from Prof. Stirling's Memoir in the Transactions of the Linnean Society of South Australia.

Plate IX.

Notoryctes typhlops Stirling, natural size, side view. Fig. 2, muzzle from front.

Plate X.

Notoryctes typhlops, skull and dentition enlarged. Fig. 1, skull side view. Fig. 2, lower jaw from behind. Figs. 3-6, superior molar from within, without, from front, and from below. Figs. 7-10, inferior molar, from within, without, above, and obliquely. Fig. 11, skull from below.

A BURIAL MOUND OF FLORIDA.

By Clarence Bloomfield Moore.

Florida's burial mounds of sand are fast disappearing through the fruitless search of the treasure-seeking native or the unsystematic explorations of the relic-hunting tourist from

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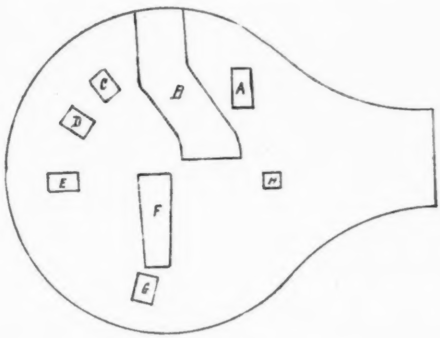

Fig. 1.
Ground Plan of Work.
A, B, C, D, E, F, G, H, various shafts and trenches.

the North. In view of this it would seem fitting to put upon record a comparatively thorough exploration of a somewhat remarkable burial mound previously unopened, and probably unknown to those making scientific investigations in connection with the burial mounds and the shell heaps of the State.[1]

[1] The late Jeffries Wyman, in referring to shell heaps not far distant, makes no mention of this mound in his memoir on "The Fresh Water Shell Mounds of the St. John's River, Florida," although carefully indicating all burial mounds coming under his notice. Le Baron, in a long list of the mounds from the mouth to the source of the St. John's (Smithsonian Report, 1882, page 771 et seq.), makes no reference to Tick Island. [It is not included in Thomas' "Catalogue of Prehistoric Works," 1891.—Ed. Am. Nat.]

Tick Island, Volusia County, Florida, is reached from the St. John's River by turning east and crossing Lake Dexter to the mouth of Spring Garden Creek, and by following the course of this creek until a tumble-down wharf of palmetto logs is reached, from whence a path half a mile in length leads to the burial mound.

Tick Island is separated from the mainland by a narrow waterway, its other boundaries being Lake Woodruff and Spring Garden Creek. The Island presents in parts a very wild appearance, covered as it is with gnarled live oak and towering palmetto, with trailing vine and tangled undergrowth, where the presence of the rattlesnake imparts a certain risk to exploration. With the exception of one small house upon the island, at intervals occupied by the hired man whose care it is to look after the orange grove, the nearest point where quarters can be secured is at Astor, eight miles distant on the river. It is, therefore, evident that the explorer with his assistants and the necessary workmen, at least four or five in number (for the throwing out of sand from a stifling trench during a hot Florida day demands frequent change of laborers), must either camp upon the island or occupy a boat chartered for the purpose.

Shape, Size, and Composition of the Mound.

The burial mound, seventeen feet in height (spirit level and tape line measurement) and in circumference four hundred and seventy-eight feet, is conical in shape, save to the East, where from the summit a gradual slope extends into a winding causeway or breastwork three hundred and ninety-two feet in length (tape line measurement), averaging four feet in height with an average breadth of twenty-five feet at base and fifteen feet at summit. The description of the composition of the mound is based upon careful observation through parts of ten days of February, March and April, 1891, during which time eight shafts and trenches were dug, the largest being forty-six and a half feet long with an average breadth of thirteen feet, and nine feet deep at the end, having from the level of the ground

followed the sloping base of shell to a point three feet vertically from the centre of the mound where operations were suspended owing to the difficulty and danger of the work, arising from the frequent caving in of heavy masses of sand. It is of course possible that an entire demolition of the mound might to a certain extent modify the conclusions embodied in this description, although in every case the results of the digging correspond in character.[1]

Dr. Brinton in his interesting chapter on the antiquities of Florida (The Floridian Peninsula), states that during his investigations he met with no stratification in the formation of any of the larger burial mounds. To this the Tick Island mound is a notable exception.

The base of the mound is composed of shells, apparently brought from the neighboring shell fields to serve as a foundation in the marshy soil.

Across the centre of this layer of shells from North to South runs a ridge of pure white sand, more like the sand of the ocean than of the surrounding fields. Above this ridge of white sand is a stratum of dark sandy loam mingled with shells,[1] while the sides of the ridge are rounded out with sandy loam in which shells are wanting, thus forming a symmetrical mound. Through the layer of shell but slight excavation was attempted, owing to its great compactness, its slope being followed at about six inches below its surface. The main trench, running in the same direction as the ridge, followed its course, and at the point where the excavation ended, the layers were respectively five, six, and three feet in thickness.

In the burial mounds at Lake Harney, at the Indian Fields on the Upper St. John's, on Dunn's Island, and at a point on the Eastern bank of the river about eight miles below Enterprise, no stratification was observed, but these mounds having

[1] Portions of the subject matter of this article are contained in a report made to the Peabody Museum of Archæology, accompanying the bones, pottery and implements secured during the investigation.

[1] It is an interesting fact that the shells of the fresh-water snail of the burial mounds and the shell heaps are larger in size than can be found at the present time in the river and adjacent lagoons.

been opened frequently are now of little value to the archæologist.

Human Remains.

During the excavations at Tick Island over one hundred skeletons were exhumed, and that many hundred still remain is beyond the shadow of a doubt.

The skeletons except one (now at Peabody Museum of Archæology) were in a very friable condition, owing to the

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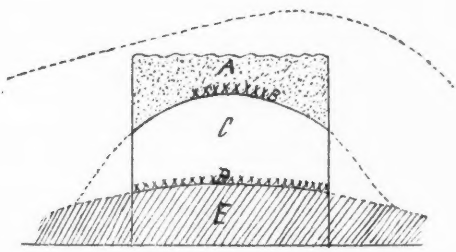

Fig. 2.

End Section of Trench B.

A, layer of sand and loam mixed with shells, B, skeletons on white sand; C, layer of white sand; D, skeletons on the shell; E, shell foundation of mound.

moisture of the sand, requiring the utmost care in handling, and even in the majority of cases rendering futile the most careful efforts to save them. The skeleton recovered entire was in the main trench five feet from the margin of the mound and three feet from the surface. It lay imbedded in the shelly base and through impregnation with lime from its surroundings it had escaped the decay occuring to such a marked extent in all the others. Above it the various strata were undisturbed, showing it to be from no intrusive burial, that *bête noire*

of the careful investigator of mounds which has led at times to so many erroneous conclusions.

The skull of this skeleton was small and round, as were all exhumed at Tick Island in a condition to bear investigation, since the large majority crumbled to pieces upon exposure to the air, or were found crushed through the weight of superimposed sand. No other bodies were found in the shells, but upon

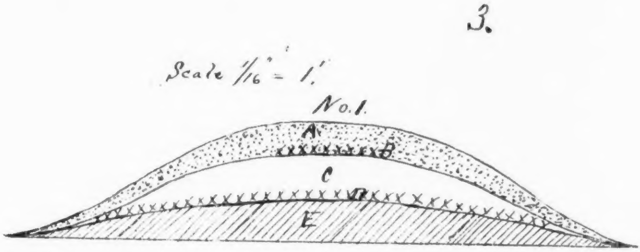

FIG. 3 (1). Section of Mound from North to South.

A, layer of shell, loam and sand; B, skeletons on white sand; C, ridge of white sand; D, skeletons on shell layer; E, shell foundation of mound.

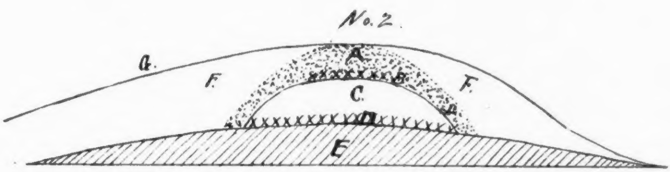

FIG. 3.

FIG. 3 (2). Section of Mound from East to West.

[Lettering same as above.]

F, sand and loam added to fill out the mound; G, gradual slope from the causeway to the summit of the mound.

it, covered with pure white sand, lay numerous skeletons of adults, in some cases the skulls in immediate contact, and this layer of bodies apparently continued through the mound. There seemed to be no fixed position for burial, the bodies lying as though thrown without arrangement, often with arms and legs flexed, and in one case the head pushed down to one

side to such an extent that a portion of the clavicle had entered the mouth.

Several facts in connection with this layer of bodies lying on the shells are very suggestive. All were adults save one, a little child, near whose head three small pots of clay were found. The bodies lay in close juxtaposition, the skulls of some crushed in as by a blow from a blunt instrument; the bones of all the bodies lay in anatomical order, while the white sand in the ridge above was precisely the same shade throughout. From all this it would seem almost conclusive that over the bodies of many men slain in battle a long ridge of pure white sand was erected, and this ridge was never disturbed by subsequent burials, no skeletons being found in the white sand. However upon it many bodies were afterwards placed at intervals and covered with a mixture of sandy loam and shells intermingled, considerably increasing the height of the ridge, which was rounded out with sandy loam to form the mound.

We are told that the lower Creeks and Seminoles hid the bodies of their dead save in the case of a victorious battle, when a mound was raised over them, a fact that would still farther strengthen the conclusion arrived at, were it possible to attribute to the Tick Island mound an origin as late as the occupancy of the Peninsula of Florida by those tribes of Indians.

Upon the mound lies a fallen live-oak that was old when the Creeks left their home to the North, and separate burials were continued long after the fight was over. Moreover, though negative testimony, any investigator of the burial mounds of Florida knows how frequently in post-Columbian times articles valued by the deceased were buried with them, and that, on the river at least, mounds erected or used for intrusive burials after the coming of the whites teem with beads of glass, and that pieces of copper, tomahawks of iron, beads and trinkets of silver and even ornaments of gold are[1] occasionally

[1]The supply of iron, copper and silver among the Indians of Florida, must be considered as obtained through the medium of the whites, and this is probably true with respect to gold which, with the silver, was derived from shipwrecks on the coast. It has been asserted that some gold found its way south from the Indians of the north of Georgia, an opinion which Mr. A. E. Douglass, to whom the author is indebted for many valuable references, has ably combated in the *American Antiquarian* for January, 1890. As to ornaments of metal found in Florida, see paper by Le Baron, Smithsonian Report 1882, page 791 et seq.

PLATE IX.

Notoryctes typhlops.

found in them. In the mound at Tick Island, though careful searchers examined each spadeful of sand, not a bead of glass

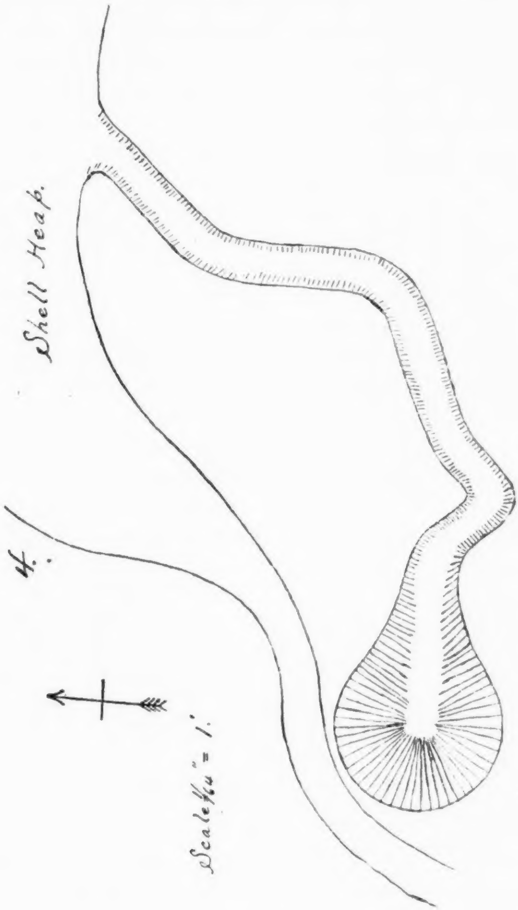

FIG. 4.
Plan of Mound and Causeway.

nor a particle of metal was discovered, a fact very strongly pointing to the conclusion that the mound was no longer used

for burial purposes when the first white men settled in the State.

In many places near the surface of the mound separate bones, or portions of skeletons not in anatomical order, were brought to light, suggestive of a custom of the earlier Indians, who are known to have exposed bodies to the elements or to have buried them until, through decomposition they were more readily enabled to separate the flesh from the bones, which were gathered together and buried at stated periods. It is possible, however, that separate bones (and these bones were always near the surface) were due to the disarrangement of previous interments caused by intrusive burials.

The teeth in all the jaws exhumed were remarkably perfect. In no case was any decay apparent and almost never was there a missing tooth, though many were unusually worn as from chewing upon hard substances, possibly fragments of shell found in conjunction with their usual diet.

A number of bones of great pathological interest were brought to light. In three excavations a number of tibiæ were found marked with anterior curvature, great increase in circumference and abnormal roughness of surface, giving evidence of a chronic inflammatory action, while in one instance, at least, a portion of a shin bone was found bearing the marks of acute inflammation. While the condition does not offer absolute evidence as to the existence of a certain blood disease[1] among the Indians who made the mound, the period of the origin of which disease is still in doubt, it is certain that it would produce like results.

Were They Cannibals?

In immediate association with at least five skeletons in the lower levels of the Tick Island mound were found bones charred and calcined by the action of fire. Of these bones portions were positively identified as belonging to the cranium and ulna.

[1]The American Journal of the Medical Sciences, August 1891, "A Contribution to the Study of Pre-Columbian Syphilis in America." By James Nevins Hyde, A. M., M. D.

That the makers of many of the shell heaps of the River were cannibals is everywhere admitted since the researches of Professor Wyman; and the writer, in January, 1873, found in a shell heap in a swamp near the west bank of the St. John's, a few miles north of Palatka, in association with the bones of the deer and other animals which had been similarly treated, many human bones showing the action of fire, and split, presumably more readily to extract the marrow. With them lay an arrow head of bluish flint. We do not know that the makers of the burial mounds and of the shell heaps were contemporary, and in the burial mounds, with the exception of the one at Huntoon's Islands, referred to by Professor Wyman (Fresh Water Shell Mounds of the St. John's River, Florida, page 28) the writer has been unable to learn of any discoveries pointing to the use of the human body for food. But the presence of these charred human remains would be difficult to explain save by the hypothesis of cannibalism or human sacrifice by fire, in which event, cannibalistic rites might possibly be included.

Perforated Crania.

Among the objects found in the Tick Island mound were two portions of separate crania; one with two perforations about the circumference of an ordinary lead pencil, the second with a similar hole in the centre and the evidence of another on its margin. The origin of these perforations is difficult to explain. No weapon known to the Indians could have caused such a perforation by a single blow, and even admitting the presence of the whites, no bullet or buckshot could have caused the holes, since the perforation was of equal size and regularity on either side, with no splintering of the inner table, as is the case with gunshot wounds of the skull.

Not far distant from these fragments was found a piece of bone (unidentified) with a perforation half an inch in diameter. In many parts of Florida pieces of shell, pottery and stone are met with, having single and double perforations, and were probably used as talismans, though it is possible that in the case of the pottery the perforations made from either side and meeting in the middle, precisely in the manner

described by Professor Morse[1] as existing in fragments of pottery, found in the shell heaps of Japan, served the same purpose as there, to furnish means of strengthening cracked earthenware or of joining that already broken. Be this as it may, perforated objects of stone and shell are found which must be considered as charms and amulets, and it is possible that the fragments of bone were put to a similar use.

But the cranial perforations at least admit of a very different explanation, if we suppose the skulls to have been buried entire with subsequent separation through pressure of sand or through decay. While perforated crania in Florida are hitherto unreported, barring hearsay testimony, their discovery is no novelty in Michigan, where numbers have been found in the great mound at Rouge River and others near Detroit. It is presumable that these holes were made more readily to suspend the cranium of an enemy, similar perforations, it is stated, being formerly customary among the head-hunting Dyaks of Borneo. For fuller details as to perforated crania the reader is referred to *American Antiquarian*, vol. xii, p. 165, and vol. ix, p. 392; also to Henry Gillman's most interesting paper in the Smithsonian Report for 1875, p. 235, et seq.

Pottery.

From the Tick Island mound hundreds of pieces of pottery were taken, the great majority rude and unornamented, the rest decorated with lines, with crossed lines and with knobs, the latter a form unfamiliar to the writer. In no case in any part of the mound were fragments of pottery discovered that had any connection with each other, no matter how closely associated. From the lowest level, pottery showing equal advancement in the arts was taken as from near the surface. It is safe to infer that these bits of pottery, many of which were shaped in a form suggestive of lance heads, were placed with the dead in fulfilment of sacred rites. The presence of broken pottery in the upper portions of the mound where the sandy loam was mixed with the shells could readily be explained by the supposition that the soil brought from the

[1]Shell Mounds of Omori, Tokio, 1879, p. 9.

neighborhood of the shell fields would naturally be intermingled with debris, but in the lower portions of the mound where pure white sand alone covered the bodies, two or three pieces of pottery were almost invariably found in close association with each skeleton usually near the skull. The Etruscans often buried hollow jewelry with their dead, doubtless not caring to waste solid ornaments on the departed. May we not infer then, that the savages of Tick Island, wretchedly poor, since not even stone was indigenous, hesitated to bury with the diseased his most precious implements upon which his descendants doubtless looked as a coveted inheritance, but rather satisfied their cupidity and their conscience by the interment of fragments of pottery in place of the cherished weapons and implements of stone.

Implements, Weapons and Ornaments.

In the main trench were found: three small earthenware pots, unornamented, lying near the body of a child an arrowhead of whitish flint; a small chisel of stone; two discs of shell, each with two small perforations; a small pebble of quartz from the seashore, around the lesser end of which a groove had been cut; four beads of shell and a number of chippings of flint. In a large excavation made on the south side of the mound were brought to light: a spear head of flint, five inches in length; one rude arrow head; one flake of flint; a large quantity of small shell beads; three barrel shaped beads made from the columella of the Busycon, or conch, two, one inch in length, the other, one and three quarter inches. Large shell beads of this kind, probably made in Florida, have been found as far north as East Tennessee[1].

Is it a Serpent Mound?

If any effigy mounds are to be found in Florida, they are of exceeding rarity. During fifteen winters spent in the State, none have come under the notice of the writer. In Emblematic Mounds and Animal "Effigies,[2]" is cited a description by S. T. Walker of an effigy mound in the form of a

[1]Fresh-water shell Mounds of the St. John's River, p. 56.
[2]By Steven D. Peet.

turtle on Long Key off the south-western coast. The author is not entirely persuaded that the shape arose from design; he informs us, however, that turtles abound in the vicinity. This is the only allusion to an effigy mound in Florida that the writer has been able to discover.

As has been stated, a long and winding causeway joins the Tick Island mound, which on this side, sloping[1]. to meet it is much less steep than elsewhere, and were the palmettoes and undergrowth cleared from the causeway the resemblance to a serpent would be strong.

In the rainy season the territory surrounding the burial mound becomes soft and swampy, and a causeway to the place of sepulture would prove a great convenience and for this purpose the causeway doubtless served, though its winding shape may have been intended also as emblematic. The raised pathway terminates at a large bean-shaped shell or refuse heap, upon which and the adjacent acres of shell-fields the Indians doubtless lived, and if the causeway were to serve as a means of communication alone, it seems fair to suppose that the natives with their limited methods of conveyance would have made it in as straight a line as possible. Moreover, a second causeway, skirting the base of the mound runs in a direct line from the great shell heap, towards the solid hammock land beyond.

It is impossible with our present light to state what race or races[2] piled up the burial mounds and by the slow deposit of debris formed the vast shell heaps of the river and of the coast, since many mounds give no evidence of intercourse with the white men, while such as do, may furnish their beads of glass and ornaments and implements of metal through the intru-

[1]This slope is found in many burial mounds, but not such a causeway.

[2]Prof. Wyman [Fresh-water Shell Mounds of the St. John's River, Florida] has estimated the age of a live oak fifteen feet four inches in circumference growing upon a shell heap investigated by him, to be not less than three hundred years. On a shell heap in the immediate vicinity of the burial mound at Tick Island, grows a live oak twenty three feet five inches in circumference. Moreover, as Professor Wyman points out, the age of trees upon shell heaps can furnish but a minimum estimate since centuries may have elapsed before the sprouting of the oak. It must, however, be borne in mind, that conclusive proof never as yet has been furnished as to the contemporaneous origin of the shell heaps and of the burial mounds of sand.

sive burials of later Indians. Hence all data are wanting as to the superstitions of the Indians who built the mounds. Still, it is well known how widely the cult of the serpent has obtained in various parts of the world, and it is not unlikely that the savages of Tick Island, where the Crotalus and other snakes are numerous, if erecting an effigy mound, should give it the form of a serpent.

We are told[1] that the Indians of the sixteenth century along the St. John's, held the serpent in veneration and treated with every mark of respect the head of a snake cut off by a soldier of De Gourgues.

Moreover, it is not infrequently the case that a conquering race, when amalgamating with a conquered people in taking possession of the soil, incorporates with its own the worship of the vanquished, and it would seem at least fair to conjecture that the worship and veneration of the serpent descended from the earlier inhabitants of Florida through Indians of whom we have historical record, to the Seminoles.

How the Seminoles of a century ago regarded the rattlesnake is amusingly told by the naive though learned William Bartram, who just before our war of Independence made a journey up the St. John's as far as Lake Beresford.[2]

In the great serpent mound of Ohio the head and the body are of nearly the same height, while a difference of thirteen feet in favor of the head exists in the Tick Island mound. Moreover the head or mound proper has been extensively used for burial purposes. In view of these facts and the probable absence of effigy mounds elsewhere in the state[3] the weight of evidence would seem to bear against the existence of a serpent mound on Tick Island. Nevertheless there are enough points in its favor to justify the writer in hazarding the suggestion.

The Height of the Florida Mound Builders.

Although not bearing directly on the Tick Island mound, yet as applying to it and to many other mounds and shell

[1]Floridian Peninsula, p. 131.

[2]Travels, Chap. IX.

[3]Prof. Putnam in a letter to the writer states that no effigy mound in Florida has ever been brought to his notice.

heaps investigated by the writer on the east coast, the west coast and the River, a few words as to the stature of the mound builders may not be considered amiss.

In forming estimates from the whole or a part of a skeleton, as to the height of the body during life there is but one basis upon which to go: actual measurement; and unless these data are furnished by men of the utmost reliability, measurements made in person are alone of value.

As the German physicians where no post mortem has been made dismiss useless theorizing as to the cause of death with the simple words "no autopsy" so it is well to put aside all reports of the finding of skeletons which, "judging from their bones must have been of giants."

In all scientific researches of this nature the explorer comes in contact with three classes of inhabitants, the conscientious resident whose memory is possibly defective; the kind-hearted inhabitant, who, having learned what information is wanted, rather than disappoint, will corroborate anything; and the facetious native, who, seeing a city man spending time and money upon what he regards as matters of small import, takes delight in filling to repletion, with marvelous details evolved from his own imagination, the person whom he considers to be a mild form of lunatic.

For a scientist with a theory to establish the native Floridian is an acquisitition beyond price.

On an average the length of the femur is about two hundred and seventy five thousandths[1] of the entire height; thus the thigh bone of a six foot man would be 19·8 inches in length. To those unfamiliar with this relative size of the thigh bone, a femur when found in nearly every case gives the idea of having done duty in a body of abnormal size.

The writer well recalls in March 1879, while engaged in an imperfect investigation of the burial mound at Bluffton on the St. John's, having found a skeleton and in association with it a pipe of stone, an arrow head and a portion of a drinking cup wrought from a human skull and ornamented—an object by the way, of great archæological interest. The femur of this

[1]Professor George A. Piersol.

skeleton seemed so large that it required the assurance of a professor of Harvard to carry conviction to the finder then unfamiliar with the ratio existing between thigh bone and skeleton, that the remains of a giant had not been disinterred.

In the burial mound at Tick Island, over one hundred skeletons were found, none belonging to men of extraordinary size, while the same holds good in the case of very many skeletons excavated by the writer on other parts of the river and the coast, while the same may be said of bones found in orange groves and cultivated land where the spade or plow of the agriculturist had left them. Great pains have been taken by the writer, and considerable distances have been traveled to inspect the bones of so-called giants and ever with a like result. The bones, if forthcoming at all, have never indicated a greater stature than can readily be found among the white men of to-day.[1]

It is true that Dr. Brinton (The Floridan Peninsula, page 171) cites a case reported to him of the finding in that State of skeletons of abnormal size. In this instance, no measurements were made, but it must be remembered, however, that even conscientious men, when measuring a skeleton laid at length upon the ground, frequently fail to make due allowance for the interlocked portions, or joints, and arrive at an estimate greater than is justified by fact. Upon the whole, it would not be unsafe to assert that the former races inhabiting Florida contained no taller men than can readily be found at the present time.

[1]The writer in May, 1891, while investigating a burial mound and certain shell fields in one of Florida's coast towns, was waited upon by a professional man of the place and informed of the recent finding of a skeleton nine feet in height. At the close of the interview, it had diminished a foot and the admission was made that the skeleton had not been personally inspected.

The writer next sought his informant's informant. According to him the skeleton was seven feet in height "and the skull would hold a peck."

Next the original finder of the bones was visited. He considered the skeleton to have belonged to a very large man, but had made no measurements. The skull alone had been kept. It proved to be somewhat below the average size.

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RECENT LITERATURE.

Kuntze's Revisio Generum. I.[1]—Whenever a work appears in which the nomenclature is not exactly the same as that of the manuals in popular use, the charge is made that the "changes" are wanton and made simply from love of novelty or a desire to bring the author to notice. There may sometimes be ground for this charge when brought against makers of catalogues or writers of short notes in magazines. None of the writers who have treated nomenclature in that strict and consistent manner which renders necessary the abandonment of some familiar names have been in a position to entirely divest themselves of suspicion, as they generally made their investigations from the start with the sole purpose of determining the validity of names in use—not as incidental to some other work. These charges cannot be made with the same force against Kuntze's Revisio Generum —the most extensive and complete as well as one of the most radical revisions of nomenclature that has yet appeared.

Kuntze made a tour around the world from 1874–1876. He began to study and classify his collections made on that tour in 1884 at the Herbarium at Berlin. He worked there until 1887, when he went to Kew, where he continued his work until the end of 1890. The result is his "Revisio." It will be seen, therefore, that he did not begin the work of revision in cold blood of malice aforethought, but was drawn into it in the course of other investigations. In classifying his collections he attempted to do something more than identify them. He studied them, and as a result wrote several monographs, of which he published some separately and incorporated others in the present work. In the present condition of nomenclature, he found that next after the proper limitation of a genus or species, the determination of the name to be applied was of the highest importance, and that the latter had become a much more difficult task in some instances than the former, as those who had worked at the one with the greatest care had used little or no care in the other. He decided to examine the names he applied with the greatest care and to reach as far as possible a permanent result. The great extent of homonymy and synonymy made it necessary for him to examine every generic name in use in order to be sure that he was giving one whose title could not be

[1] Revisio Generum Plantarum Vascularium omnium et Cellularium multarum secundum Leges Nomenclaturæ Internationales cum Enumeratione Plantarum in Itinere Mundi Collectarum—Mit Erlaeuterungen. von Dr. Otto Kuntze, 1891. (In two parts).

doubted. To do this thoroughly, implied a revision of all the genera and he proceeded at once to examine the original sources and make a revision *de novo* instead of contenting himself with leaning upon the work of others. What ever may be thought of the result, in this case the motive can hardly be impeached. And it must be said, however radical his views on nomenclature seem, that in all other respects he is in the main very conservative. He repeatedly expresses his approval of Bentham and Hooker's limitations of genera and condemns severely the multiplication of genera or species.

He bases his revision upon the rules of the Congress at Paris in 1867, giving them a strict construction in order to prevent any doubt. He shows that these rules have not been followed in practice, but that there is no alternative between them and chaos in nomenclature. Some confusion has arisen also from defects in these rules—or as he expresses it, he found "leaks" in them. These leaks he has attempted to repair by framing additions and amendments to the rules. He made a thorough and complete revision of all the genera of Phanerogams and Pteridophytes and of many genera of Bryophytes, Fungi and Algæ which came to his notice in revising the nomenclature of the Phanerogams—as he was forced to examine everywhere to be sure that the names he adopted were not in prior use elsewhere. There is no complete unity in the work, for, besides the revision of nomenclature, in a few cases he has made a revision of the contents of a genus, or a monograph of the genus or some part of it, perhaps extending even to forms of a species. There is also a list of plants collected on his tour, dovetailed into the revision. The book seems to be a compilation of the work he did upon his collection or which he was drawn into in the progress of that work. It would take a critic almost as long to verify the work as it did the author to do it, and I wish it understood that the statements hereinafter made are on the authority of the work itself unless otherwise indicated.

The book opens with a long and somewhat rambling preface in which the author describes the circumstances which led him into the work. He then takes up the vital question of the necessity of such a revision and gives three principal causes of the alterations he has made. The first arises from matters of form as prescribed by the international rules. Some of these he has formulated more strictly and "completed in order to abate the multitude of variations and to bring controverted cases to an easy decision." "Many persons," he adds, "will recognize for the first time out of the mass of alterations the difficulties which inconsistencies in this respect may produce and the

necessity of fixed ground principles for nomenclature." The second cause is, "Correction of and atonement for accomplished wrong. This is the greatly preponderating cause of the restoration of many rightful names." "It is strange," he continues, "that the children of Flora, the advocates of *scientia amabilis* have so often given occasion in their naming '*nichts weniger als* amabiles *zu sein*' towards their comrades." The third cause is that monographers and universal systematists have mostly slighted the revision of generic names. Where they have had it brought to their notice, they have made some revisions, but for the most part they have taken what names they found. "Monographers," he says, "ought to have such revision in view next after their principal object; but they are often not in a position to do this, as in the correlation of homonymy the nomenclature of the whole system must be examined, for which the monographers mostly have not the requisite materials. In the concentration of their powers upon the internal work of the monograph, this revision is often discontinued. The universal systematists moreover, rely principally upon the monographs and seldom correct them—in this *circulus vitiosus* a careful study of the older sources is let slip by all."

In the introduction to his revision he supplements this statement by a detailed account of the causes of the present state of nomenclature; and the large number of examples which he gives certainly show a much more chaotic condition than one would suppose, even in spite of the discussions going on in the magazines, and the unfamiliar names to be met with in every new catalogue. "Above all," he says, "my revision shows that the present condition of botanical nomenclature is still very unhealthy. The great Linné indeed reformed Botany, but unfortunately he introduced a taint at the same time which has transmitted itself with botanists.........namely unfairness towards co-workers. If this taint does not disappear, the international nomenclature must perish, and this aid to an understanding between botanists become bankrupt. The botanical Congress in Paris in 1867 first made way for the cure. I hope through this work to accelerate it."

He also discusses in the preface the "Benthamain-rule" that a species-name is only an incident to the genus name and the international rule that "a name is a name." He criticises Bentham quite severely, and in the main justly, and gives some interesting examples of the way he multiplies species-names on changing a species from one genus to another. He shows that this was a general practice of the successors of Linnæus and of botanists early in this century, and observes that it is not to be expected that Englishmen will abandon this old

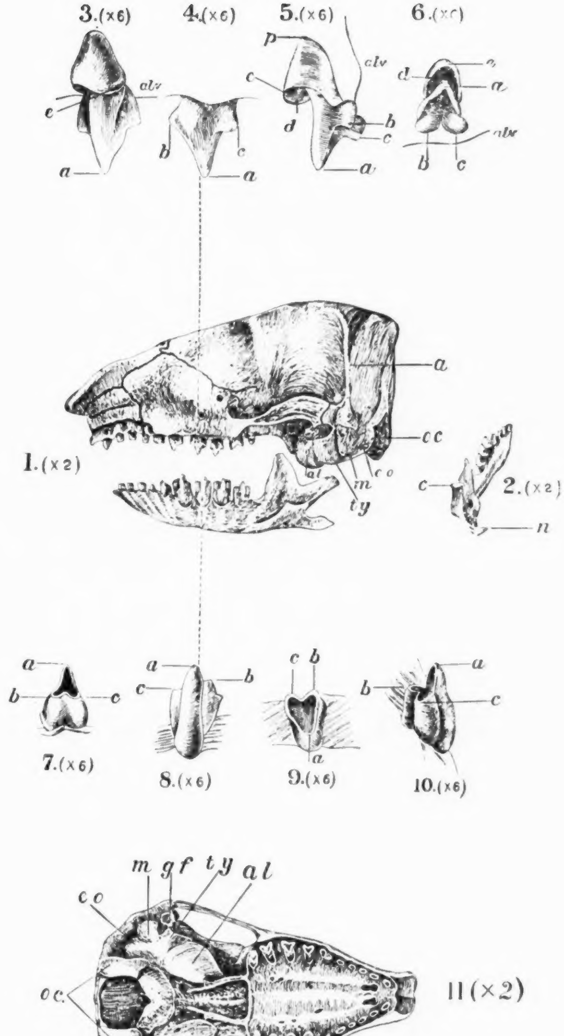
method merely because it produces inconvenience and confusion and adopt the international principle, any more than that they will even adopt the metric system or the centigrade thermometer or decimal system of money. In this section of modern English nomenclature he enlarges upon this in discussing "the renewed Kew rule" which is nothing but Bentham's rule again. He then discusses author-citation. After devoting some time to criticising the Boisierian or "pietistic" method, he gives his own view which is somewhat novel. The following extract also shows a characteristic of the book which strikes one very oddly at first. That is its polyglot composition (of also the title). English, French and Latin come unexpectedly upon the reader in the midst of the German on every page. The words in italics are in English in the original.

"Convolvulus reptans L. 1753 = Ipomœa aquatica Forsk 1775 (*misfortune or mostly piracy*) = Ipomœa reptans L (*pietism*) = Ipomœa reptans (L) Pois (*seduction*) = Ipomœa reptans Pois (L) (*correctness*) = Ipomœa reptans Pois (*International*)." He thinks that "Ipomœa reptans Pois (Convolvulus reptans L.)" is the proper citation, and as an abbreviation of that he gets I. reptans Pois. (L.) "Earlier," he continues, "it seemed to me indifferent in which position the two authors were to be cited. But the citation of both authors in the sequence which I have denominated 'seduction' seduces through the practice of abbreviation by omitting the 'Pois,' unconsciously to the false method of pietism......and is therefore to be rejected."

Admitting that "the citation of two authors alone leads to order" does it follow that the evil he deprecates will be obviated by the method proposed? Will a lazy or a hasty man be more certain to abbreviate by omitting the last author than by leaving out the first? Will he not be pretty sure to leave out the name in parenthesis wherever it stands? Or at least will he not be governed by a bias toward pietism or the reverse quite as much as by the order in which the names are written? It seems to me that his objection is fanciful and that his citation might well be termed "*distraction*" as increasing the already too numerous methods of citation.

After the preface there is a long introduction. He first treats of the materials for revision. Section 1 is devoted to a severe criticism of Durand's Index to Bentham and Hooker's Genera Plantarum—"BHgp" he abbreviates it. Among other things he charges that a large part of the index, including some errors, is borrowed without credit from Pfeiffer's *Nomenclator Botanicus*.

PLATE X.



Notoryctes typhlops.

Section 2 is entitled "Certain common causes of the many mistakes in Durand's Index and on the future prevention of such mistakes." The first cause is inconsistent treatment of authors. Some are entirely neglected unless they were the emendators of a genus, while other "*beliebte Autoren,*" though pre-Linnæan, are cited even to emended genera. Another cause, he points out, is inconsistency and confusion in the use of the abbreviations "MS.," "ined." etc. He distinguishes "such names found or given in MS. as are adopted and published by another author" from "names found in MS. which another author rejects, but which are published as synonyms." These he says are badly confused in practice, and he distinguishes the latter as "*nomina inapplicata* (n. inapl)" and the former as "*nomina adoptata* (n. adopt.)" He also points out the confusion resulting from irregular use of *non* for *p. p. emend.*, etc. and shows the cases to which it should be restricted. It will be seen that he is very strict as to the smallest details. It often seems as if the distinctions he draws were too small to notice until his formidable lists of the results of looseness are examined. He cites copiously and apparently exhaustively on every point and argues with some force.

In section 3 he considers Pfeiffer's "*Nomenclator Botanicus*" at some length, criticising some parts of it a little. Incidentally he says that neither Pfeiffer nor Durand took enough time for their work, and that as a result the former is "leaky," and the latter *sorgloss fehlervoll.*"

Sections 4–12 deal with the "principal causes of the present condition of nomenclature." Section 4 is entitled "Linné's competition with his contemporaries." Linné, it seems, in reforming nomenclature, besides changing many bad names, "wilfully altered many good earlier genus names" and after 1737 was very free in altering the names given by those of his contemporaries who ventured to criticise him or who did not adopt his nomenclature. Says Kuntze: "Linné was great as an investigator, a discriminating observer, an ingenious thinker with immense talent for 'Systematics,' a tireless worker, an attached pupil, a genial man and on the whole an honorable character; but excessively greedy of honor. Easily accessible to flattery, very prone to neglect of acknowledgment, tolerating no opposition, feeling himself an autocrat; he often needlessly changed names (even those which he himself had previously adopted) and chastised his opponents and '*nichtbewunderer*' by neglect of the names adopted or given by them. He actually held it allowable to criticise the newly created genera of his contemporaries, if he adopted them or to apply

the names to entirely different plants. In this way he monopolized his nomenclature."

How far we may not be forced to tolerate this in Linné because of the necessity of a fixed foundation for nomenclature is a question which perhaps merits more careful consideration than Kuntze has given it. But there is no such reason in the case of Linné imitators, and as the root of all evil in nomenclature, they should not be allowed to escape with impunity. Linné is not the only man who considered himself the autocrat of botanical nomenclature. Subsequently, would-be despots and obligarchies have asserted this authority with great vigor. There are those now who assume a divine right to say what shall be and what shall not be, and, while crying out at all changes by others, themselves often make changes at will; retaining only those names which they or their ancestors have approved and made current.

In this connection Kuntze gives a list of the authors whom Linné slighted and whose names he 'rebaptized' and a number of examples of Linné's method. Two must be given, and they are not the worst: "upon Cardamine lunaria L = Lunaria aegyptica Juss. Adanson based a new genus, Scopolia. 'Immediately on this discovery,' writes Medicus, 'Linné separated it again from Cardamine, recognizing it as a separate genus, but changed the name Scopolia to Ricolia.'" Another case is Heisteria L. 1737, dedicated to Heister, a contemporary. Heister afterwards ventured to remonstrate against Linné's "shameful alterations in nomenclature," whereupon Linné chastized him by changing Heisteria to Muraltia (1767)!

Section 5, entitled "Inconsistencies of Linné and his contemporaries, and their alterations of their own names," continues the same subject, giving a large number of interesting examples.

Section 6 is headed "Brutal lawlessness of nomenclature after Linné until the beginning of the XIX century; Robert Brown, etc." The period treated of in this section might well be termed the feudal period of Botany. "After Linné's death" says Kuntze......"anarchy broke out, as in other cases in history after the death of a reformer and dictator." There were on the one hand the heirs of Linné–*i.e.* the editors of the successive editions of his works, and on the other, a number of imitators of him, great Barons, as it were, none great enough to fill his place, and all more or less at war. Name-alteration went on pretty steadily now, and it is to this period that we are indebted for most of the present disorder in nomenclature. At this time was it that the habit of changing the species name of a plant put in a new genus, which is now perpetuated by the "renewed Kew rule,"

was formed. Says Kuntze: This was the flowering time of botanical robber-knighthood, the followers of which, for a part, were able investigators, but respected no author's right."

His remarks on Robert Brown in this connection are especially interesting. He says: "He was a great botanist *mit allüren eines Despoten* "..........."Except Linné, who, however was a reformer of nomenclature and system, and in zeal for their introduction often went too far, no author, relatively, has offered me so many opportunities to correct the names wrongfully introduced or preferred by him as Robert Brown." "Under Robert Brown's great influence, a clique arose (Smith, Richard, Lindley, Wallich, Bentham) which has done marked injustice to certain other botanists.........[Salisbury for one;] yes one can say that he has founded a school in unrighteousness, of which many traces are to be found in 'BHgp.'"

Section 7 treats of "different conceptions of valid genus-formation." He distinguishes and limits *nomina nuda* (names published without description.) "So long," he says, "as the plant is sufficiently known, there is need neither of a plate nor of a description. Only when recognition is impossible, is the name to be marked '*nomen tantum*' or *nomen nudum*, etc." Bentham and Hooker do great injustice to Salisbury by dismissing with the words '*nomen tautum*' etc. the names of valid genera founded by him and published without description, but with reference to well known types upon which they were founded in a way that left no room for doubt. On the contrary they carefully protect the names in Wallich's Catalogue, the application of which, he charges, is sometimes very hard to recognize. "One does not name the description, but the plant, and defective diagnoses are often more perplexing than none at all."

We cannot blame Kuntze for remarking upon the injustice done to Salisbury. But in this case (and it is the only one as far as I have found) he departs from his customary strict interpretation of the rules. Common sense is doubtless on his side. But common sense differs considerably according to the person applying it; and Kuntze has warned us too many times against the slightest relaxation of rules.

Section 8. "Name-alterations by raising sections into genera and through linguistic changes," is the basis of some alterations in the international rules proposed by him. The subject will be considered later.

A very interesting section is section 9, entitled "Homonymy, a powerful cause of name-alteration and abiding source of danger to botanical nomenclature." Most of the cases of homonymy arise from

the repeated use of the same personal name, in the hope, apparently, that it will stick in some one place, and some obscure man can be honored in the end. There are a goodly number however which have not even this semblance of an excuse. Kuntze gives a list of *one hundred and fifty* personal genus-names which have been repeatedly and differently applied in this way—two of them to *seven* different groups, two to *six* groups and *fourteen to five!* As he says, this is a fearful list.

In order to furnish those who are desirous of honoring some person at all hazards a means of so doing without imperiling nomenclature he explains a number of devices by means of which a personal name can be made in so many ways that hereafter there should be no difficulty in providing even for such numerous families as the Smiths and Joneses. He gives a long list of precedents of endings, prefixes and combinations: some very good, some very bad, and a few so atrocious that even he is compelled to exclaim at them. He also gives examples of anagrams and translations—some of them very good—and of "*zusammengezogene*" personal names, of which Pahlomagunsia O. K. is a fair sample. But this is not all. He thinks the termination "ago" when joined to a personal name very euphonious and gives some examples: Pritzelago O. K. To him "ago" suggests "agere" and seems suitable to a compiler. So he would say: Steudelago, Pfeifferago etc. An anatomist would get a "*toma*" attached to his name. (Does this refer to the fact that the person honored would be likely to *cut* him after making such a name?) Linné sometimes attached *inda* to the generic name of an Indian plant. So *inda, afra amra and asia* he considers proper terminations for genera dedicated to travelers or botanists in India, Africa, America and Asia. He makes for us on this theory Watsonamara O K., Schweinfurthafra O K. and many others. Fries made a genus "Aaretis" for M. A. Aretis. This is all well enough for once, but Kuntze takes him up with "Pasaccardoa" O K. (for P. A. Saccardo) and outdoes him with a suggested "Sirhookera." I do not believe such a collection of monstrosities was ever brought together before, the names fairly pack two pages of this section. It would be better that every man he so "honors" be forgotten, than that his name be made ridiculous forever by being joined to "carpum" or "fungus" after the manner of "Peckifungus" O K.; Henningsocarpum" O K.; "Philipimalva" O K etc. The possibilities of the field he has opened up for us are indeed great, witness: Smithia; Smithago; Johnsmithotoma; Igsmithia (J. G. Smith;) Smithialga; Smithodendrum. I dwell on this because it seems to me

that botanical Latin is impure enough already without such gratuitous monstrosities. The rule against names formed from two languages almost reaches them; good taste certainly ought to condemn them. It may be well enough to call attention to precedents for the sake of those who are determined to honor some person at all events, but like tracheotomy, they should be the last resort.—ROSCOE POUND.

(*Concluded in March Number.*)

Systematische and Topographische Anatomie des Hundes, Bearbeitet von Ellenberger und Baum.—*Berlin, Paul Parey*, 1891, pp. 646.—This book was produced at the suggestion of the veteran physiologist, Ludwig, of Leipzig (and one would be obliged to search far before arriving at a field of scientific work in any way related to animal physiology in which his suggestions have not borne good fruit). It is intended for zoologists, veterinarians and physiologists, more especially for the two former, for whom it places the dog on a plane with the horse and the ox, whose anatomy has been carefully worked out. For the physiologist it will rank with the works of Krause on the rabbit and Ecker on the frog. That it has been greatly needed will be acknowledged by all who have had to deal with the dog from the morphological, physiological, or medical standpoints. That it represents a vast amount of faithful labor on the part of the authors, who are instructors in the veterinary college at Dresden, not only in the examination of literature, but more especially in the practical study, with scalpel and forceps, is evident from a survey of the book itself. It is purely systematic and topographical, as the title indicates, all histological, ontogenetic, phylogenetic, comparative anatomical and physiological considerations (except as to the actions of the muscles), being omitted. The rigid restriction of the subject matter in this respect is a detraction and must result in narrowing the circle of users of the book. A broader treatment from the comparative standpoint would have added greatly to the interest and value. In this line the short discussions of the race differences in the various bones of the skeleton are an interesting feature. The physiologist can not fail to notice the lack of good descriptions and figures elucidating the physiological anatomy of the body. He has his Cyon, it is true, but Cyon is not all sufficient. The two hundred and eight figures in the text are with few exceptions original, and mostly of unusual excellence. Thirty-seven plates represent sections through the body in different planes and regions, and are given to show the topography of the parts, chiefly for operative purposes.

As a purely anatomical work it is excellent. It will be much more useful to veterinarians than to any other class of readers and it was largely written for them. However, no one in any way interested in the anatomy of the dog can afford to be without it; and it is gratifying to have the labor performed for the first time so faithfully and so well. An English translation should be made.—MORITZ FISCHER.

General Notes.

GEOLOGY AND PALEONTOLOGY.

The Crystalline Cambrian Deposits in Massachusetts. *The Essex Bull.*, vol. xxiii, 1891, publishes another paper by Mr. J. H. Sears, on the Olenellus Cambrian rocks of Essex County, Mass. The numerous out-crops of these rocks, their position and condition lead the author to the following theory:

That during the Cambrian period a vast sheet of these sediments was deposited over the entire region to the depth of some hundreds of feet. They have been distorted and crumpled into anticlinal and synclinal folds by the intrusion of eruptive rocks. The distortion left their entire surface a series of cracks and faults, which made them a prey to the forces of erosion and decay. The ice sheet during the glacial period scoured these sedimentary beds and ground the rocks to boulders and fine till, which is now scattered over Cape Ann and in the neighboring waters of the Atlantic Ocean. This would account for the absence of glacial grooves on the surface of granite areas, for the ice sheet probably never touched the greater portion of the granite area. Aerial decay has since destroyed all that was left of the sedimentary beds after the ice period, except such remnants as are found to-day. The absence of fossils in many of the beds is due to contact metamorphism.

The Fauna of the Armorician Sandstones.—M. Charles Barrois has recently published (*Ann. Soc. Geol. du Nord. Avril*, 1891) a memoir in which he describes the fauna, and discusses the systematic position of the Armorician sandstones of Bretagne. The fauna consists of 151 sponges, 155 Brachiopods, 157 Lamellibranchs, 212 Gastropods, 218 Pteropods, and 219 Crustaceans. In giving the biological characters of the fauna, the writer calls attention to the very slight ornamentation of the shells of the Lamellibranchs. They are characterized by equal valves and by the length of the cardinal line. A

careful comparison with equivalent faunas of other regions shows that the fauna of the Armorician sandstones is intermediate between the primordial and that of Llandeilo. The advanced types of the Lamellibranchs induces M. Barrois to correlate these sandstones with the lower beds of Llandeilo rather than with those of Trimadoc.

Relations of the Chemung-Catskill Group to the Lower Carboniferous.—In an address before the section of Geology and Geography at the Washington meeting of the A. A. A. S., Prof. John Stevenson suggested that the Catskill as well as some portion of the Chemung may be contemporaneous with the lower beds of the lower Carboniferous of Ohio, and instances the following facts as having a bearing upon the question:

"*First,* That the Chemung and Catskill deposits were laid down in a shallow basin subsiding most rapidly at the East and along a line rudely parallel to the Blue Ridge trench.

"*Second,* That the deposits would be much greater near the mainland at the East than at two hundred miles away; so that six hundred feet more or less of fine material in Ohio would more than fairly represent the four thousand feet of Chemung in Eastern Pennsylvania.

"*Third,* That the water beyond the reach of the great land wash held a Chemung fauna throughout the whole line of the Catskill deposit." (Proceeds. A. A. A. S., vol. xl, 1891.)

Water-Bearing Horizons of Southern New Jersey.—Mr. Lewis Woolman reports the discovery of a third water-bearing horizon at Atlantic City, N. J. It is probable that these three horizons continue under the beaches South of Barnegat Inlet and beneath the Southern interior to a distance of 25 or 30 miles or more from the coast. The two upper ones have an intimate connection with a diatomaceous clay-bed, having a thickness of 300 feet. In view of the thickness and extent of the diatomaceous clay-bed in New Jersey, Mr. Woolman thinks its prolongation into the Southern Atlantic States should be expected, and that there is a strong probability that the outcrops on Chesapeake Bay near Annapolis, at Nomini Cliffs, and at Richmond, Va., are either identical with the New Jersey stratum or closely related to it and belonging to the same series (Annual Rept. N. J. Geol. Surv., 1890).

Prizes of the London Geological Society for 1891.—The medals and funds to be given at the anniversary meeting of the Geological Society on February 19, have been awarded as follows:—The Wollaston medal to Baron Ferdinand von Richthofen; the Murchison medal to Professor A. H. Green, F. R. S.; and the Lyell medal to Mr. George H. Moreton. The balance of the proceeds of the Wollaston Fund to Mr. O. A. Derby; that of the Murchison Fund to Mr. Beeby Thompson; that of the Lyell Fund to Mr. E. A. Walford and Mr. J. W. Gregory, and a portion of the Barlow-Jameson Fund to Prof. C. Mayer-Eymar. (Geol. Mag. Feb., 1892.)

Interval Between the Glacial Epochs.—In the Bull. Geol. Soc. Am., April, 1890, Mr. T. C. Chamberlin presents additional evidences bearing upon the interval between the Glacial Epochs; viz, that the early glacial plains are trenched by interglacial valleys. An examination of the lower Mississippi shows that the erosion amounts in round numbers to a trench about 300 feet in depth and about sixty miles in width. This erosion represents the interval between the formation of the silts of the earlier glacial epochs and the filling in of the valley deposits of the later glacial epochs. The upper Ohio and Allegheny, the Susquehanna, and the Delaware rivers have done a corresponding amount of work. The cutting of these trenches rudely measures the length of the interval between the glacial epochs, or at least the length of the actively erosive part of it.

Arkansas Geological Survey, 1890.—A report on Manganese, its Uses, Ores and Deposits,[1] by Dr. R. A. F. Penrose, Jr. has recently been published by the Arkansas Geological Survey. In order to ascertain the importance of the Arkansas deposits Dr. Penrose visited and personally examined every known manganese region in North America—those of Arkansas, Georgia, Tennessee, Virginia, Vermont, Texas, Arizona, Colorado, California, Oregon, Nevada, Utah, Nova Scotia and New Brunswick. The conclusions given in the report are therefore based upon direct personal observations, and are thoroughly trustworthy.

The author discusses (1) The uses of manganese, together with the history and statistics of the manganese industry; (2) The ores of manganese; (3) The nature of the manganese deposits. The chapter on the origin and chemical relations of manganese deposits is of special

[1] Annual Report Arkansas Geological Survey, 1890, vol. I. Manganese; Its Uses, Ores, and Deposits. By R. A. F. Penrose, Jr., Ph. D.

interest to the general reader. The sources of the metal, the forms and conditions of deposition and precipitation, and the geologic distribution, are given in a clear, concise and orderly way that shows a mastery of the subject.

The richest deposits in the United States are confined almost entirely to the Cambrian and Silurian rocks, while in Canada they are found in the Lower Carboniferous.

Dr. Penrose accounts for the variability in the quantity of ore, in different horizons, and in different places in the same horizon, by the conditions surrounding the deposition.

A geological map of the Batesville, Arkansas, region is folded in the pocket of the volume, and the text is still further illustrated by a number of figures and plates.

Geological Survey of Texas, 1890.[2]—The Second Annual Report of the State Geologist of Texas is a quarto of 756 pages, replete with information, valuable not only to the citizens of the state, but also to the geologists at large. The report of the State and Field Geologists are followed by an admirable series of papers which take up in detail a study of each formation with its various economic minerals and possibilities. Messrs. Dumble, Birkinbine, Lerche, Kennedy, Herndon and Walker report on the Iron Ore District of East Texas; Mr. Cummings gives the geology of the north-western part of the State; Mr. Comstock the geology and mineral resources of the central mineral region; and, finally, Mr. Streerowitz describes the geology and mineral resources of Trans-Pecos, Texas.

A separate chapter is given to a description, by Alpheus Hyatt, of the Carboniferous Cephalopods. These forms being extremely limited in their chronological distribution are helpful in distinguishing the age of the rocks in which they are found, and it was therefore decided to have them all published in one treatise.

The report is abundantly illustrated with plates, sections and maps, which add materially to its value and interest.

Geological News-General.—It is the opinion of Mr. Waldemar Lindgren that there exists in southern Lower California two orographic lines of great importance. (1) A comparatively recent, probably Post-cretacic line of dislocation extending from the vicinity of La Paz northward for many hundred miles along the eastern coast. (2) A

[2] Second Annual Report of the Geological Survey of Texas, 1890. E. T. Dumble, State Geologist.

line along which an uplift of much greater age than the first one has taken place, runs near the western shore of the peninsula. This line is indicated by several short ranges mostly composed of crystalline schists and granite. It is probable that the mesa sandstones have been derived from this older area by erosion. (Proceeds. Cal. Acad. Sci. vol. III. Pt. 1.)—Dr. Lydekker has recently published a summary of the present state of knowledge of the Fossil Birds found in Great Britain. He has embodied in this summary brief descriptions of typical specimens, pointing out some of the more striking features by which particular bones of certain groups may be recognized. The total number of species recorded in various collections is slightly over 60. This includes, however, birds of the superficial deposits, many of which belong to existing species; the list of extinct forms admitted as valid, falls short of 20.

Paleozoic.—Contributions to the Micro-Palæontology, Part III, has recently been published by the Geological Survey of Canada. It consists of a report on Ostracoda from the Cambro-Silurian, Silurian, and Devonian rocks at various localities in the Dominion by Prof. Rupert T. Jones, with a critical note on the species described by him in 1858. It contains forty-one pages of letter press, illustrated by four full page lithographic plates and five wood cuts.——W. B. Dwight has recently found a fossiliferous stratum of the Paradoxides zone at Stissing, New York. The species collected consists of *Leperditia ebenina, Kutorgina stissingensis, Olenoides stissingensis,* all undescribed, and a Hyolithes, probably "Billingsii."——Four new Silurian fossils have been described by Mr. Whiteaves; *Srophomena acanthoptera, Pentamerus decussatus, Gomphoceras parvulum,* and *Acidaspis perarmata.* The fossils are the characteristic ones of an area of Silurian rocks discovered by Mr. J. B. Tyrrell on the Northeast side of Lake Winnipegosis, on Cedar Lake, and on the Saskatchewan River below Cedar Lake. (Can. Rec. Sci., April, 1891.)

Cenozoic.—The frontlet and horn-cores of an antelope discovered by Dr. Leeson in the Plistocene deposits near Twickenham have been identified by A. Smith Woodward as those of *Saiga tatarica.* The remains of Saiga have been found in France and Belgium, but until now there has been no evidence of the occurrence of this animal in the British area. (Proceeds. Lond. Zool. Soc., Nov. 4, 1890.)——The Geol. Survey of the United Kingdom has recently published a memoir by E. T. Newton embracing an account of all the Vertebrata

from the Pliocene deposits of Britain. The total number catalogued and discussed by the author is 212, of which 20 have evidently been derived from eocene rocks. After the elimination of derived and doubtful forms, about 142 definite species remain which have been tabulated as follows:

	Number of Species.	Occur also in Lower Beds.	Lived on to a Later Period.	Living Species.	Extinct Species.	Percentage of Living Forms.
Nodule bed below The Red Crag.....	68	—	20	6	62	8.8
Coralline Crag.....	15	8	8	5	10	—
Red Crag..........	6	5	5	3	3	—
Norwich Crag.....	21	10	12	5	16	—
Weybourn Crag...	7	5	6	5	2	—
Forest-bed.........	65	17	47	45	20	69.2

Mesozoic.—Mr. A. Smith Woodward has recognized three reptilian bones in a collection of vertebrate fossils from the Cretaceous formation of Bahia, Brazil. Two of the bones represent the articular end of a large Pterosaurian quadrate, while the third is a Plesiosaurian. The pterodactyle is the first of the kind in the Southern hemisphere, and the discovery of the Plesiosauri adds another important locality to the known distribution of that order. (Ann. & Mag. Nat. Hist., Oct., 1891.)——According to R. S. Tarr, the Permian of Texas in its most typical development was a completely enclosed sea. This is proved by the nature of its beds. In no other way can the numerous layers of gypsum and salt be accounted for. It would also explain the redness of the clays and sandstone beds. The peculiar sickly gray color of the limestone is that of an inland sea deposit, and the abundance of vertebrate fossils of both land and inland sea types is thus accounted for. The small break between the Carboniferous and the Permian shows that in point of time the formations were immediately associated, the marked difference in the nature of the beds, and the character of the fauna being due rather to changed conditions than to actual lapse of time. (Am. Journ. Science, Jan., 1892.)

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—Several contributions to the subject of the origin of spherulites have recently been made by Messrs. Cross and Iddings, and one on the minerals occurring in hollow spherulites by the latter gentleman and Penfield. Iddings[2] distinguishes two kinds of spherulites; one composed of radial fibres forming the compact spherulite; and the second consisting of jointed and branching fibres of feldspar, separated by tridymite scales and gas cavities. Gradations between small, dense spherulites composed of micro-felsite, and large ones, the nature of whose structure can be determined, were traced in many instances, and from them the conclusion is reached that microfelsite is in many cases but a microscopic intergrowth of feldspars, elongated parallel to the clino-axis, and quartz, and that the spherulites are but special phases of granophyric growths. The discovery of tourmaline and mica, especially near the margins of spherulites, is an additional proof of the correctness of Iddings' view that spherulites are the result of crystallization of pasty rhyolitic magma under the influence of moisture. These two minerals are younger than the smaller compact radial spherulites of the rock, and older than the final crystallization of the residual magma between the spherulites. In the porous spherulites with branching fibres, or the lityophysae, some of the fibres are negative and others positive in the nature of their double refraction; that is, some are orthoclase crystals elongated parallel to *c*, with the plane of the optical axes normal to the plane of symmetry, and others are elongated parallel to *a*, with the plane of the optical axes in the plane of symmetry. The essential characteristic of spherulitic growth is the internal structure of the spherulites. They are not made up of amorphous substances under a strain, but of definitely crystallized minerals arranged radially with one or several centres of crystallization. Under this head, according to the author, would fall granophyric intergrowths, which are radially branching aggregates of orthoclase and quartz. Cross[3] places emphasis on the valuelessness of the term microfelsite in petrographical nomenclature, as he finds the material to be an aggregate of quartz and orthoclase, two definite minerals, and not the ill-defined substance described by Rosenbusch. He attacks both Rosenbusch's and Levy's classification of spherulites as incapable of covering the handsome bodies found by himself in the

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] *Bull. Phil. Soc.*, Washington, xi, p. 445.

[3] Ibid, xi, p. 411.

rhyolites of the Silver-Cliff-Rosita mining district in Custer County, Colorado, where spherulites occur of all sizes, up to ten feet in diameter. All are products of the consolidation of a magma, whose composition is

SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	MgO	K_2O	Na_2O	H_2O
71.56	13.10	.61	.28	.16	.74	.14	4.06	3.77	5.52

or about $\frac{2}{3}$ alkaline feldspar and $\frac{1}{3}$ free silica, from which nearly all of the Ca, Mg, etc., had been separated as phenocrysts of plagioclase before the formation of the spherulites. The oldest of the spherulites are minute bodies, in some of which a granophyric growth is detectable. The large ones are found in many generations. Some contain internal cavities, while others are compact. The hollow spherulites are composed of radiating branching orthoclases, with opal and other forms of silica between the fibres, forming a mass through which are scattered minute balls of tridymite or grains of quartz. Another type of spherulite is the trichitic, in which the feldspars are branched and curved to an unusual degree, forming a radiating bunch parallel to whose radii trichites of magnetite are arranged. Both hollow and trichitic spherulites are often surrounded by a supplemental growth in which the feldspar is in very delicate needles. The various generations of spherulites locally make up the entire rock, but usually there is a little residual material consisting of glass, of another radiate growth, or of a combination of both. Compound spherulites are composed of regular orientations of successive growths. The many spherulites of quartz that have been described are thought by the author to be largely feldspar and quartz aggregates, in which the orthoclase is elongated parallel to *c* with the abnormal optical orientation, and thus have a positive double refraction, when they are with difficulty distinguished from quartz microlites. Cross has traced unmistakable prismatic orthoclase down into fibres, and so seems warranted in stating that determinations of the character of the material of spherulites based entirely on the character of the double refraction of the fibres are worthless. Some of the spherulites of the Colorado occurrence consist entirely of positive feldspar, while others are composed of mixtures of this with a negative variety. With reference to the origin of spherulites, Cross reaches the same conclusion as that reached by Iddings; the mass in which spherulitic growth was set up must have come to rest and consequently must have been pasty, since fluidal lines cross the spherulites undisturbed in their courses. During the formation of some of the spherulites the mass again became pasty, and in

certain areas became colloidal, then rapid crystallization was set up and the branching forms resulted.——Though the main features of the Rapakiwi granite have long been well-known through the descriptions of Ungern-Sternberg, but little information has been granted us as to its occurrence and structural peculiarities. A recent article by Sederholm[4] gives an account of the varieties of the rock and outlines their modes of occurrence. The peculiarity common to all varieties is the occurrence of porphyritic crystals and the possession of a granophyric ground mass. The prevailing type possesses phenocrysts having an elliptical form and surrounded by a rim of oligoclase. The orthoclase is never pure, but it contains plagioclase particles and grains of quartz, and biotite or hornblende, the usual constituents of the ground mass. These inclusions are often arranged concentrically. The peculiarity of the structure of the ground mass is the idiomorphism of the quartz, which is often intergrown with the feldspar, lepidomelane and hornblende in micropegmatitic forms. The place of the orthoclase phenocrysts is sometimes taken by an aggregate of orthoclase and quartz grains, surrounded by a radiating rim of orthoclase and an exterior one of plagioclase. Miarolitic cavities are filled with fluorite. As the orthoclase becomes smaller the structure of the rock becomes more granitic, at the same time the amount of orthoclase decreases and microcline takes its place. The finest grained varieties occur as dykes in the others, and are finely granophyric. All these varieties occur in the Wiborg district in South Finland, where, on account of their remarkably easy weathering and the consequent production of granitic debris, they are well known. This easy weathering is ascribed by the author to mechanical rather than chemical agencies. At Åland and other regions types are found resembling more or less closely those described. In some porphyritic crystals of oligoclase occur in a micropegmatitic ground mass of quartz and orthoclase, and in others porphyritic quartzes in a granophyric ground mass. Between the branches of the quartz in the granophyre are small areas of coarse grain, and in these are found the miarolitic cavities. Not only do the rocks described occur in Southern Finland, but they are found also in the Southwestern portion of the same country, as well as on the islands off its coast and in the Eastern part of Sweden. All the varieties are supposed to be phases of the same magma, the coarse-grained, deep-seated facies and the granophyric surface forms. For granitic rocks with idiomorphic quartz the author proposes to use the descriptive

[4]Min. u. Petrog. Mitth., xii, p. 1.

term *anoterite*, because probably found at a less depth than the true granite. All the Rapakiwi rocks are thought to be post-archean, but not older than early Cambrian. Structurally they are supposed to represent the source of great radiating dykes and flows (Taphrolites). ——Among some rocks obtained by Doelter from the Cape Verde Islands, Eigel[5] has discovered an augite-diorite, augite-syenite, nepheline basalt, and two doubtful types, which he places respectively with the teschnites and phonolites. The augite-diorite consists of orthoclase in well-formed crystals, and gray plagioclase in lath-shaped individuals, and irregular grains of augite and hornblende. The nepheline basalt occurs as dykes in the diorite, and is composed of phenocrysts of augite and plagioclase, a few olivines and probably orthoclase in a ground mass of nepheline, plagioclase and grains of augite and hornblende. The rocks to which the author assigns a place with the teschnites consist in large part of a ground mass of altered anorthite and orthoclase, in which are brown augite and hornblende, both altered on their edges to dilorite, a little biotite, magnetite and apatite. The composition of one of these is given as:

SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	K_2O	Na_2O	H_2O
39.64	16.98	6.61	9.31	10.58	6.65	3.09	5.95	1.32

The phonolites are fine-grained rocks, made up of porphyritic crystals of acmite and red augite, sometimes zonally intergrown, and hornblende, in a ground mass consisting of microlites of hornblende, augite, biotite, orthoclase, plagioclase, muscovite and magnetite, and little grains of a colorless mineral, probably orthoclase, in an isotropic base. Nepheline could not be detected microscopically, but is supposed to be present as the result of chemical tests. One specimen contains regularly outlined icositetrahedra composed of a nucleus of calcite and sahlite, and an external zone of biotite, that are regarded as altered garnets. Since this rock occurs between a well characterized phonolite and limestone it is thought to be a contact facies of the former.

The trachytes, andesites, basalts, etc. of the Upper Eifel have been subjected to a very careful investigation by Vogelsang.[6] The phonolite and the leucite and nepheline basanites have no peculiar characteristics which need be referred to here. The basalts include plagioclase, leucite and nepheline varieties, the former two of which have effected alteration in sandstones and graywackes, with which they are in contact. The trachytes are very much like the Drachenfels rock,

[5] *Mineralog. u. Petrog. Mitth.*, 1890, xii, p. 91.
[6] *Zeit. d. d. geol. Gesell.*, xliii, 1890, p. 1.

and like some specimens of this, contains tridymite in its ground mass. The most interesting type studied is hornblende andesite. This also contains tridymite in its ground mass, and also contains parallel growths of biotite and hornblende with OP of the former parallel to $\infty P\breve{\infty}$ of the latter. The hornblende is much corroded, and new hornblende and feldspar are among the products of its solution. Large numbers of concretions are characteristic of the rock. There are granular aggregates of cordierite, andalusite, sillimanite, feldspar, biotite, pleonast, corundum, rutile, quartz, garnet, zircon and magnetite, and are sometimes schistose. The author thinks that they were originally inclusions of sillimanite-cordierite gneiss or schist that were altered by contact with the molten mass of the andesite. He strengthens his supposition by treating cordierite-sillimanite rocks with andesite material, when he obtains an abundance of pleonast, which is one of the most characteristic minerals of the aggregates.——The leucitophyres of the Laacher-See region have again been subjected to a very thorough microscopical study. Martin[7] has found them to consist principally of sanidine, leucite, nepheline, augite, and sometimes biotite and melanite phenocrysts in a ground mass of sanidine, nepheline and green augite, together with a little glassy base. He regards them as tertiary in age and separates them into two groups, according to the presence or absence of melanite. The former contain but 48.50–49.25% of SiO_2, while in the latter the percentage of this constituent rises to 53–54%. The mineral in the rock from Perlerkopf, thought by Rosenbusch to be perofskite, is melanite. The rocks from Seeberg, called trachyte by Zickel, are phonolites containing green and violet augite and nests of olivine. There appear to be gradations between the phonolites and fasanites. The leucite-tufa of the region is a leucitophyre-tuff and the leucitophyre-nepheline tephrites and nephelinites of the Harmebacher Ley are all nephelinites. Some of Selberg are feldspathic basalts and nepheline basalts, the latter with leucite crystals altered to zeolites and augites filled with hornblende inclusions.

At Democrat Hill and Mt. Robinson in the Rosita Hills, Col., are two vents of old solfataras, whose gases have so affected the rhyolite surrounding them that two entirely new and unique rocks have resulted. At the former place the original rhyolite is now replaced according to Mr. Cross[8] by a cellular rock composed of alunite and quartz, and sometimes a little kaolin, whose cavities are lined with

[7] *Zeit. d. d. geol. Gesell.*, xlii, p. 151.

[8] *Amer. Jour. Sci.*, June, 1891, p. 466,

crystals of the first two minerals. The alunite is tabular and has a composition:

SiO_2	Al_2O_3	K_2O	Na_2O	SO_3	H_2O	Fe_2O_3, etc.
65.94	12.95	2.32	1.19	12.47	4.47	.55

At Mt. Robinson the alunite rock is not quite so regular in character, since it contains in places little tablets of barite. Toward the West of the ridge on the top of the mountain is another unique rock composed almost entirely of quartz and diaspore. The composition of this rock is as follows:

SiO_2	TiO_2	Al_2O_3	Fe_2O_3	CaO	Alk	SO_3	P_2O_5	H_2O
76.22	.11	19.45	tr.	tr.	tr.	.29	.13	3.82

An analysis of the diaspore crystals implanted on the walls of its cavities yielded $Al_2O_3 = 83.97$; $H_2O = 15.43$.——Among the Archean schists of the Argentine Republic Kühn[9] finds gneisses, mica schists, quartzite and phyllite. In the last three rocks but little of special interest was noted except in the case of the quartzite, where cordierite is supposed to have been discovered. The gneisses are divided into biotitic, muscovitic, and granulitic varieties, and a variety containing two micas. Each group contains fine and medium grained kinds, and one—the biolitic group— embraces a series of "augen-gneiss." The eyes are feldspars, whose outlines indicate that they were originally phenocrysts in a porphyritic granite. Fractured crystal components, peripheral granulation of some of its constituents and an undulous extinction in others, all indicate that the rock has been subjected to enormous pressure. In connection with the discussion as to its origin the author gives an account of the views held on the subject of the origin of gneisses, and discusses their probable correctness. He concludes that gneisses produced by pressure became schistose after their constituents had formed, and that their schistosity is a direct result of the plasticity of the rock mass under pressure, and is not a consequence of numerous fracturings and re-cementings, as Lehmann would have us suppose. With reference to the chemical changes produced by dynamo-metamorphism the author gives descriptions of the alteration of garnet into biotite, and of tourmaline into pinite. He also gives an account of the weathering of garnet into hornblende, and of biotite into chlorite and epidote. The article is particularly interesting in its treatment of the characteristics of schistosity and the origin of the schistose structure.——The constituents of the pegmatite veins

[9] *Neues Jahrb. f. Min.* etc.; B. B. vii, p. 295.

cutting the crystalline schists and granites of the Western part of the Argentine Republic have been carefully examined by Sabensky.[10] They are aggregates of orthoclase, microline, quartz and mica, with plagioclase, biotite, chlorite, tourmaline, garnet, beryl, apatite, zircon and hematite as accessory components. Both the potassium feldspars are intergrown with albite lamellæ, inlaid parallel to a plane between $\infty P\overline{\infty}$ and $2P\overline{\infty}$. The microline offered a fine opportunity for the study of its characteristics. An untwinned specimen gave as a mean of the measurements of its cleavage faces the angles 89° 30.6′ and 90° 29.4′. The peculiar grid-iron structure seen in certain thin sections of the minerals are ascribed to twinning according to the albite law, and not to a combination of twins according to the albite and pericline laws. The arguments brought forward in support of this view are too involved to be dealt with in this place. They are clearly stated in the author's article. Gas and fluid inclusions were formed in the quartz, which mineral often possesses an undulous extinction. Quartz and feldspar are frequently intergrown to give rise to the graphic structure. This is explained by the author as a regular intergrowth of the two minerals in a manner analogous to that of orthoclase and albite, *i. e.*, the quartz follows easy cleavage planes in the feldspar.

Mineralogical News.—Of some rare Argentine minerals recently described by Klockmann[11] the following deserve notice: *Eukarite, Umangite* and *Luzonite.* The first named is regarded by the author as a member of the galena group, in spite of the fact that it appears to possess a foliated structure and an hexagonal habit. One analysis yielded: $Ag = 43.13$; $Cu = 25.32$: $Se = 31.55$, corresponding to Ag, Cu, Se, or a jolpaite in which Se replaces S. The mineral occurs in a vein with calcite and umangite, cutting a limestone of unknown age. The *umangite* has heretofore been mistaken for barite. An analysis of the purest material obtainable gave: $Cu = 56.03$; $Ag = 49$; $Se = 41.44$; Co_2, H_2O, etc., $= 2.04$, which corrected for impurities gives a result corresponding to $Cu_3\ Se_2$. Its density is 5.620. The mineral, which is new, is found massive and in the form of a very full-grained granular aggregate. Its hardness is 3. It has a metallic lustre and is opaque. Its streak is black, while its color in consequence of corrosion is a dark, cherry red or violet. The name is taken from the locality in which it occurs—on the West slope of the Sierra de

[10] *Neues Jahrb. fur Min.*, etc., B. B. vii, p. 359.

[11] *Zeits. f. Kryst,* xix, 1891, p. 265.

Umango, La Rioja. *Luzonite* was described by Weisbach from Luzon, Philippine Islands, as a substance in all probability isomorphous with famatinite. It however has the composition of enargite, which according to Stelzner is not isomorphous with famatinite. Klockmann thinks the latter mineral and luzonite isomorphous, and regards luzonite as the dimorphous form of enargite. The luzonite is associated with barite as a reddish gray or light copper-red, massive substance with a hardness of 3.5 and a density 4.390. Its composition is Cu = 47.36; I = 32.40; As = 16.94; Sb = 3.08. The locality given for it is Sierra de Famatina, La Rioja.——Analyses of *astrophyllite* from the cryolite locality at St. Peter's Dome, Colo., and of *tscheffkinite* from Bedford Co., Va., yielded Eakins[12] respectively:

Ta_2O_5	SiO_2	TiO_2	LrO_2	ThO	$(YEr)_2O_3$	$(LaDi)_2O_3$	Ce_2O_3	Al_2O_3	Fe_2O_3	FeO	MnO
.34	35.23	11.40	1.21					tr.	3.73	29.02	5.52
.08	20.21	18.78	tr(?)	.85	1.82	19.72	20.05	3.60	1.88	6.91	

CaO	MgO	K_2O	Na_2O	H_2O	Sp.Gr.
.22	.13	5.42	3.63	4.18	
4.05	.55		.06	.94	4.33

$R_4'' R_4' Si(SiO_4)_4$

The astrophyllite was very pure, so that the figures of the analysis must be regarded as representing accurately the composition of the substance, especially since they correspond so closely to the formula suggested by Brögger as the result of Bäckstroms investigation. The tscheffkinite was somewhat altered. In thin section Mr. Cross found a brownish transparent amorphous substance crossed by cracks containing reddish brown ochreous decomposition products and bands of colorless minerals that appear to be calcite and sphene, besides several darker minerals. The material analyzed by Price[13] was found upon examination to be as complex in composition, so that it seems probable that the substance has no place among minerals.——The *kamacite, tænite* and *plessite* found in the Welland meteorite[14] were so easily separable that Davidson[15] has succeeded in obtaining a sufficient quantity of each for analyses. The kamacite is brittle and of the color of cast iron, while tænite is silvery in lustre and is flexible. The results of the analyses are as follows:

	Fe	Ni	Co	C
Kamacite . .	93.09	6.69	.25	.02
Tænite . .	74.78	24.32	.33	.50

[12] *Amer. Jour. Sci.*, July, 1891, p. 34.

[13] *Amer. Chem. Jour.*, Jan. 1888, p. 38.

[14] *Howell. Proc. Rochester Ac. Sci.*, 1890, p. 86.

[15] ib., p. 64.

Both are magnetic, the latter evincing stronger polarity than the former. In etching the kamacite is attacked more rapidly than the richer alloy of nickel. Plessite was found to consist of fine lamellae of the two alloys above mentioned.——Brown[16] has carefully examined the *bernardinite* first described by J. M. Silliman,[17] from San Bernardino Co., Cal., as a new mineral resin, and has discovered it to be in all probability the fungus *Polyporus officinalis.*——Weed finds[18] that the ore deposit of the Mount Morgan gold mine in Queensland, Australia, is a siliceous sinter like that of the Yellowstone National Park, impregnated with auriferous hematite. Both the sinter and the hematite are clearly hot spring deposits. A brief abstract of a paper read by Dr. Foote[19] at the Washington meeting of the A. A. A. S., gives an account of the discovery of black and colorless *diamonds* in a fragment of meteoric iron weighing forty pounds found at Crater Mt., about two hundred miles North of Tucson, Ariz. The diamonds usually occur associated with amorphous carbon in the cavities in the mass, which contains about 3% of Ni.——Census Bulletin No. 49, by Mr. Kunz[20] contains a brief account of the value of gems and precious stones discovered and worked up in the United States during the year 1889. The total value of the materials found within the country amounted to $188,807. Agatized wood, turquoise, zircon, and quartz in the order mentioned are the most important domestic productions falling under the head of precious stones used as ornaments or gems.

[16] *Amer. Jour. Sci.*, July, 1891, p. 46.

[17] ib., xviii, p. 57.

[18] ib., Aug., 1891, p. 166.

[19] *Scientific American*, N. Y., Aug. 29, 1891, and *Amer. Jour. Sci.*, Nov., 1891, p.

[20] Census Bulletin No 49, April 14, 1891.

ZOOLOGY.

The Nervous System of Echinoderms.—The recent work of Jean Demoor and Marcellin Chapeaux on the nervous system of the *Asteracanthion rubens* is embodied in a paper published in Tidsch. Nederland. Dierk. Vereen, II Serie vol. iii. The subject is treated both from an anatomical and physiological point of view. It includes also a systematic account of the effect of poisons and of heat upon *Asteracanthion rubens.* The authors sum up their conclusions as follows:

"The nervous system of the star-fish is differentiated into two systems, the condensed and the diffused, between which however, one finds it difficult to draw a sharp distinction. The functions are however now specialized in this large group, for we have shown that the two nervous fields have a distinct and peculiar functional aspect. Each presenting a distinct activity, they divide between themselves the work which is appropriate to the life of relation. Owing to the close connection which exists between them, the two systems can aid each other and work together for the accomplishment of the multiple manifestations induced by the different conditions external and internal, by the sensations arising from stimuli, and by reaction. To the diffused nervous system is attributed above all the role of perception and of sensation. It is the one that gives the organism a notion of its position and which informs it of its state of equilibrium. It is the one also which accumulating those diverse and vague organic impressions, which the physiologist groups under the name "kynetic," keeps the animal in constant activity and readiness to respond to stimuli.

"The motive impulses, properly speaking, the external manifestations of vital phenomena do not depend directly upon the diffused system. Their real centre is the condensed system which must then be the true organ of reactionary impulses. It is the centre in which are generated the reflex motions; it contains cell groups whose functions are definitely specialized, and which thus form the first traces of a more advanced type in which the different important manifestations of activity have become localized in distinct regions. The two nervous systems are intimately connected. The innumerable relations which unite them render their functional agreements close and each reinforces the other. From this last point of view a progressive specialization is also manifested. In fact, the conduction of excitations causing the

ordinary sensations which are important only in the aggregate, is accomplished by means of the hidden fibrillæ which unite the condensed with the diffused system. On the contrary, some ways of direct communication between the two systems have been established physiologically for the special excitations before provoking a quick response, necessary and fatal. The easy propagation of the sensations thus allows the corresponding motor centers to readily respond."

The Land Molluscan Fauna of British New Guinea.—Last year Mr. C. Hedley had an opportunity of collecting and studying the land shells of this little-known region and has embodied the results in a paper published in the Proceeds. Linn. Soc. vol. vi. The author states that for the convenience of students he gives in his paper a summary of the knowledge of this fauna up to date.

The land shells of this province exhibit four rather distinct geographical divisions:

(a) The alpine fauna, whose sole known member is *Rhytida globosa.*

(b) The region lying between Port Moresby and the Fly River. The types in this region are *Hadra broadbentii, Geotrochus tayloriana* and *Helecina coxenii.* Mr. Hedley believes that the tropical Mollusca of Queensland were probably derived from this fauna, by migration across the dry bed of Torres Straits.

(c) A province which includes the eastern extremity of New Guinea with the outlying islands, of which the typical members are *Hadra rehseii, Nanina bunsteinii,* and *Geotrochus brumeriensis.*

(d) The Louisiade, D'entrecasteaux, Trobriand, and Woodlark Archipelagos. Characteristic forms are the Geotrochi allied to *louisiadensis* and the gigantic Pupinellæ allied to *grandis.* The author thinks that the occurence of *G. welsianus* and *P. brazieræ* on Fergusson Is. would indicate that the fauna of these islands will prove to be related to that of the distant Louisiades rather than to that of the nearer mainland.

Of the 110 species described by Mr. Hedley, 25 are new, and have been carefully figured, many of them magnified, to assist in identification.

The Pycnogonid Eye.—Mr. T. H. Morgan has been studying the structure and development of the eyes of Pycnogonids, and he sums up the results as follows:

"I believe all the layers of the Pycnogonid eye give abundant evidence that the eye has developed by the turning in of two sides of a primitive optic vesicle, and that the simple eyes of insects furnish all

the intermediate stages, both in development and adult structure, between a simple cup-like invagination and the three layered condition of the Pycnogonid eye.

"I am inclined to push this a step further and attempt to show that the median Arachnid eyes have developed along a similar path, and this must be a necessary corollary to the position to which I have assigned the Pycnogonids, and believe, that the inversion of the Spider's eye in its Pycnogonid stage of evolution and the righting of it a secondary and later change. I also believe there is no evidence that in the evolution of the Spider's eye a change of position in the lens has taken place." (Studies Biol. Lab. Johns Hopkins Univ. vol. v. No. 1.)

Lateral Sense-Organs of Elasmobranchs.—At the meeting of the Royal Society of Edinburgh, Dec. 21, 1891, Prof. Corsar Ewart read the second part of a paper written by himself and J. C. Mitchell, on the lateral sense-organs of Elasmobranchs. In this part the authors deal with the sensory canals in *Raia batis*. It has been supposed that these canals serve for the production of mucus. The authors consider that this idea must be abandoned. They have observed a number of mucus glands in the skin sufficient to account for all the mucus found on the surface. They incline to the opinion that the canals have some respiratory functions. (Nature, Jan. 7, 1892.)

South American Siluroids.—G. A. Boulenger has published (Proc. Zool. Soc. Lond. April, 1891) an account of the Siluroid Fishes obtained by Dr. von Ihering and Mr. Wolff in Rio Grande do Sul, Brazil. The following is a list of the new species added to the Brazilian fauna: *Pimelodella eigenmanni* n. sp. n. for *P. buckleyi* E. & E. not Boulenger. 2, *Pseudopimelodus cottoides*, 3, *Otocinclus nigricauda*, 4, *Bunocephalus iheringii*, 5, *Trichomycterus minutus*.

Bunocephalus iheringii is interesting from the fact that no other species of the Aspredinidæ have so far been found south of the Amazons.—C. E. EIGENMANN.

The Spermatophores of Diemyctylus.—The fertilization of the Urodela has been until lately very imperfectly understood. The recent observation of Gasco and Zellu on European forms, and Gage's studies of Diemyctylus have proved beyond a doubt that fertilization is internal, but there is no direct cloacal contact between the sexes.

If a female newt be examined during the months of May and June spermatozoa will be found in the cloaca, not inside the mouth of the oviduct as might be expected, but closely packed in the ducts of two groups of gland-like structures situated in the cloacal wall just below the entrance of the oviducts. The question as to how the spermatozoa find their way to these snug resting-places is an interesting one. According to Mr. E. O. Jordan the explanation lies in what Pfeffer calls "positive chemotaxis." He thinks it probable that the pelvic glands of the female newt may secrete a substance—proteid or otherwise—with a positively chemotactic effect and thus draw the spermatozoa into its ducts.

During copulation both animals are motionless, sometimes for hours, with the exception of a fanning movement of the tail by the male, which is sometimes repeated by his mate. From this position the male passes gradually into a more violent stage, which has been wrongly stated by some authors to extend over the whole period. At the climax of agitation the male leaves the female, and with his tail slightly raised, his cloaca widely distended with numerous white protruding papillæ, waits for the female to follow him. If she does this and presses her head lightly against the cloacal region, the male deposits a spermatophore and then creeps on to a distance of a few centimeters, where, if the female still continues to follow him, he deposits another. Three is the number generally discharged.

"The spermatophore consists" to quote Mr. Jordan, "of three parts: a thick, irregular mass about six millimeters in diameter which adheres to the bottom of the aquarium ; a tough elastic spine projecting upwards from the base ; and, borne on this spine, an approximately spherical mass of spermatozoa about one and one-half millimeters in diameter, this mass being a sort of concretion of small balls of spermatozoa."

After the male has deposited the first spermatophore he moves forward with the female following him. In so doing she naturally brushes over the spermatophore and the mass of spermatozoa adheres to the cloacal lips and passes thence into the cloacal chamber. The chance of the spermatophore's fulfilling its mission is about 1 to 4.

It is difficult to understand why the spermatozoa choose to pass into the female cloaca rather than into the surrounding water unless a positively chemotactic influence is supposed. It is possible that the pointed spine in Diemyctylus may play an important part in the transaction. The elastic spine easily bent down by the female passing over it, and as easily springing up when the entrance of the cloaca is

reached would seem adapted for effecting the entrance of the spermatozoa; but this is not the invariable mode of entrance. It more frequently happens that the spermatozoa are deposited on the cloacal lips and the surrounding skin so that the final conclusion of Mr. Jordan is that as in the European form reported by Zellu "the spermatozoa find their way to the 'Samentaschen' by virtue of their own activity." (Journ. Morph. vol. v., No. 2.)

A New Species of Wandering Albatross.—Sir Walter Buller has lately had an opportunity of examining sixteen examples of a supposed new bird, collected on the Aukland Islands and off the New Zealand coast, and has no hesitation in declaring it to be a distinct species, readily distinguishable from *Diomedea exulans* by its larger size, by its perfectly white head and neck from the nest to maturity, and by its having the bare eyelids jet-black, at all ages. This albatross being the noblest of the whole group, he selects fcr it the distinctive specific name of *Diomedea regia.* It nests earlier than *D. exulans*, actually hatching out its young in the Aukland Islands whilst the other species is only preparing to lay. (New Zealand Journ. Sci. 1891.)

The Temperature of the Dog.—Dr. Wesley Mills has been investigating the subject and has published the following results in Forest and Stream Jan. 28, 1892.

Range of temperature for the twenty-four hours.

Greyhound Dog (Two years old.) Hours.	Temp. in degrees F.	Gordon Setter Bitch (About the same age.) Hours.	Temp. in degrees F.
10.00 A. M.	102.0	10.00 A. M.	101.4
12.00 M.	102.2	12.00 A. M.	102.2
2.00 P. M.	102.4	2.00 P. M.	101.7
5.30 P. M.	101.7	5.30 P. M.	101.9
8.15 P. M.	101.5	8.15 P. M.	101.6
10.30 P. M.	101.5	10.30 P. M.	101.6
12.00 P. M.	101.4	12.00 P. M.	101.2
2.00 A. M.	101.4	2.00 A. M.	100.8
4.00 A. M.	100.4	4.00 A. M.	100.7
6.00 A. M.	100.4	6.00 A. M.	100.8
7.40 A. M.	100.6	7.40 A. M.	100.5

The temperature was taken in the rectum in each instance for ten minutes. As the experiments were intended to be scientifically accurate, a self-registering thermometer with a Kew certificate testifying that the instrument was strictly accurate, was used. Such a one costs three dollars, but for ordinary work a good instrument can be secured at a lower price; nevertheless it does not pay to buy a cheap instrument.

The next table is the consecutive temperatures in one day for a Great Dane Bitch, eight months old.

Hours.	Deg. F.	Hours.	Deg. F.
8.30 A. M.	102.8	6.15 P. M.	101.7
10.00 A. M.	101.9	8.00 P. M.	101.1
2.00 P. M.	101.3	10.00 P. M.	100.5
4.15 P. M.	101.5		

It will be seen in this case the temperature in one instance reached almost 103 degrees.

The temperature in puppies is rather higher and decidedly more variable than in grown dogs. The following table for two English setter puppies of the same litter, nine months old, illustrates this less than it does the variations for the same breed and individual kept under precisely the same conditions:

Hours.	Temp. in degrees F.	Hours.	Temp. in degrees F.
8.30 A. M.	102.2	8.30 A. M.	102.5
11.00 A. M.	102.6	11.00 A. M.	102.4
2.00 P. M.	102.7	2.00 P. M.	102.5
5.00 P. M.	101.7	5.00 P. M.	101.9
7.00 P. M.	101.9	7.00 P. M.	101.9
9.00 P. M.	102.2	9.00 P. M.	101.6

It will be noted that the temperature in the case of one of these puppies reached 102 degrees, or higher, four times in twelve hours.

Zoological News.—Mollusca.—According to J. G. Cooper, the peninsula of Lower California has as yet yielded but 24 species of terrestrial Mollusca, 3 of which are Californian, while the rest belong to tropical groups but are in general peculiar to the peninsula. A curious fact to be noted is that 2 of the species occur in the similar arid regions of western South America and nowhere in the intervening moist regions. (Proceeds. Cal. Acad. Science, vol. iii., p. 1.)

Arthropoda.—Mr. Arthur Dendy has recorded observations that go to show that *Peripatus leuckartii* is oviparous. It lays its eggs in July and the young are hatched at the end of October. This is a singular departure from the habit of members of this genus, since in all the other species of Peripatus whose life-history is known the young are born alive. (Zool. Anz. Dec. 1891.)—According to W. W. Smith, *Pompilus fugax*, *P. monachus*, and *P. carbonarius*, the spider-hunting wasps of New Zealand, are never at a loss for food in their native land. The former, unlike many indigenous Hymenoptera, is slowly increasing in numbers owing to the abundant food supply.—(New Zeal. Journ. Sci. No. 3, vol. I.) **Vertebrata.**—The Congo Collection of fishes in the Zool. Mus. of Utrecht has been examined by L. Schilthins who thinks he is justified in regarding ten species and one genus as new to science. Descriptions, with figures of these novelties are published in Tidsc. Nederland. Dierk. Vereeing, 2d Serie, Deel III.—C. H. and R. Eigenmann report an addition of 21 species, 11 of which are new to the ichthyological fauna of San Diego. (Proceeds. Cal. Acad. Sci. vol. iii., Pt. 1.)—According to Mr. A. Butler the Carolina Parrakeet (*Conurus carolinensis,*) whose range is now confined to quite restricted areas in some of our Southern States, was formerly known as a characteristic bird of Indiana. At the time of its greatest range in that State, within historic times, it was known from New York, Pennsylvania and Maryland to Kansas, Nebraska, and possibly Colorado. (Auk. vol. ix., Jan., 1892.)—A series of tortoises found in Key West prove upon examination by Mr. Garman to belong with a specimen from Cuba described by him in 1887 to which only a generic name was attached. This tortoise is closely related to *Cinosterinum pennsylvanicum* and has been given the name of *C. baurii*.—M. C. Judson Herrick has recently published a paper entitled, Studies in the Topography of the Rodent Brain. The types chosen for these studies were *Erethizon dorsatus* and *Geomys bursarius*, partly because they seem to be aberrant members of the rodent stock and present striking peculiarities both in habits and general structure. *Erethizon dorsatus* is the only North American representative of the Hystricidæ. *Geomys bursarius*, the "pocket gopher" of the West, is widely separated from the other Myomorpha by its fossorial and nocturnal habit and the peculiarities of structure resulting from it. The paper is prefaced by one containing an interesting account of the habits of the Rodents under discussion together with those of the Muskrat (*Fiber zibethicus*), and some points in their anatomy more or less bearing directly upon their anatomy. (Bull. Sci. Lab. Dennison Univ. vol. vi. Pt. 1.)

EMBRYOLOGY.[1]

Epigenesis or Evolution?[2]—One part of this paper is devoted to the results of certain experiments upon the action of light upon the cleavage of eggs. These show that the eggs of *Echinus microtuberculatus, Planorbis carinatus?* and *Rana esculenta* undergo cleavage and the early stages of organ formation equally well in darkness, white light or colored light. Light then has no effect upon the early stages of development, though others have shown that the presence or absence as well as the color of light does have an effect upon the later stages of differentiation of embryos.

The main portion of the paper, however, contains the most interesting results: that from one of the first two blastomeres of the egg of *Echinus microtuberculatus,* and the same is true of a species of *Sphœrechinus,* a complete pluteus of normal form but of half the normal size may be reared!

Owing to the importance of these experiments as bearing upon the value of the blastomeres upon the question of early potential reparation of organs within the egg, that is, upon the question of evolution as opposed to epigenesis, it will be necessary to give here a brief account of the author's methods, from which the chance of error may be deduced.

When the first cleavage furrow has come in, 50–100 eggs are shaken vigorously for five minutes, with little water in a test tube 4 cm. long and 0·6 cm. wide, then quickly poured into clean sea water and examined. If the right moment has been taken, neither too soon nor too late, some of the blastomeres will be found not only isolated but still alive, others of course dead, or not separated from their fellows as the egg membrane does not always burst open. There is also great variations in the resistance offered by eggs of different individuals—some may need to be shaken several times.

The best isolated cells are removed and placed two or three together in sea water in solid watch glasses covered, and with a hanging drop on the cover to diminish evaporation and concentration of the sea water. In these glasses the embryos develop and were observed from time to time without removal.

[1] Edited by Dr. T. H. Morgan, Bryn Mawr College, Bryn Mawr Penn.

[2] Hans Driesch: Entwick lungs mechanische Studien. Zeit. f. wis. Zool. liii, Nov., 1891.

The normal cleavage as shown by Selenka is accomplished as follows: two meridional furrows followed by an equatorial make eight equal cells, four of which bud out four little cells at one pole while the other four divide. There is thus a stage with 16 cells, marked by 4 small ones at one pole: these remain evident during the 28, 32, 60, 108 cell stages.

Now in the great majority of artificially isolated single blastospheres the cleavage results in the formation of a half blastula. The single cell divides into 2 and then in 4 equal cells: then the two upper cells bud off two small cells while the two lower cells divide, forming then 8 cells arranged just like one-half of the normal 16 cell stage. The time taken for the half-egg to reach the 8 cell stage is the same as for the whole egg to reach the 16 cell stage.

Though in the majority of cases the evening of the first day saw half blastulas formed from the half-eggs, there were also present certain cases in which from the first or from later stages of cleavage the half-egg formed a symmetrical though small sphere, not a half sphere.

The next morning revealed actively swimming complete blastulæ formed from the half blastulæ, though of small size, yet normal. How the half sphere closed in was not observed. As they are only one-half the normal size yet have cells of the normal size the number of cells must be one-half the normal. Whatever the mode of closure of the half-sphere may be, its occurence shows that the half-egg is able to furnish a complete individual, both right and left, anterior and posterior, dorsal and ventral parts, and had not given up part of this power to the other egg-half.

Of the 30 perfect blastulas only 15 survived the second day—as is often the case with normally formed blastulas in small vessels. On the morning of the third day active gastrulas were observed, fifteen individuals. They then take on the prismatic form, mouth and arms are formed and the normal course is followed until finally, in 3 cases, normal, but small, plutei were raised.

If each half-egg may thus form a complete individual the possibility of forming twins by partial separation of the first two blastomeres is obvious. In fact very many cases of twin formation resulted from the experiments above recorded though in eggs not shaken none were observed amongst the many examined in other work. There is thus probability that the partial separation of blastomeres may give rise to twins. Of the numerous cases of twins actually observed one is especially noticeable as it shows that from a much injured two celled stage there resulted an apparently normal blastula which after two

days divided into two almost separated spheres each of which became a gastrula and finally a pluteus attached by a narrow isthmus to its fellow.

This abnormal action of the embryo is not confined to a simple two-fold division: in three cases the blastula divided into a $\frac{3}{4}$ and a $\frac{1}{4}$ section of which the former became plutei and the latter, in one case a gastrula. The general distribution of this power to produce complete individuals was more striking in a case where $\frac{3}{4}$ of a shaken egg, in the two celled stage, died and the remaining $\frac{1}{4}$ of the egg became a normal blastula!

Attempts made by the author to separate the blastomeres of Frogs and of Planorbis have as yet been unsuccessful. There seems need of extension of this experimental work before any wide-reaching conclusions can be drawn.

Regeneration of Lost Parts.[1]—In these two papers the author has given an important addition to our knowledge of the process of regeneration of the tail in Batrachia. Both adult and larval urodeles and larval anurans were used, though most of the work refers to Rana and to Siredon larvæ. In the first paper the interesting fact is established that tails cut off obliquely do not grow out straight at first, but at right angles to the cut surface, up or down, right or left as the case may be. Yet they become later like the original tails. This change the author assigns to the effect of use, to functional adaptation. This is made probable by a number of experiments in which larvæ were kept in deep and in shallow water, could or could not use the tail. Some of the final straightening in the non-swimmers is referred to the effect of gravitation, but there still remain cases in which only the "directive power" of the organism seems to be concerned in the ultimate return of the new tail to its proper use.

The great length of the second paper forbids its proper treatment in the present notice. Its chief advance over previous work, of which it furnishes a good confirmation, lies in the discovery of the fact that the histological changes concerned in the formation of the new tail repeat, on the whole, those of the ontogeny, not only in kind but in the time of appearance. Thus the epidermis is first regenerated, then the spinal cord, chorda, connective tissue, cutis, blood-vessels, striated muscles and peripheral nerves in the order given. Simple tissues are quickly regenerated, the more specialized, more slowly. Moreover,

[1] D. Barfurth. (1) Versuch zur functionellen Anpassung. (2) Zur Regeneration der gewebe Arch. f. mik. Anat. xxxvii, May, 1891.

the mode of formation of tissues like that in the embryo is dependent upon the ontogenetic stage of the individual, repeating only what is proper to the formation of such tissues at that stage.

Embryology of Rotifers.[1]—Passing over the anatomical and biological sections of the present long paper, interesting as are the new facts brought forward to support the author's belief in a symbiosis between certain rotifers and certain hepatic mosses, and the careful anatomical work upon the Callidinas studied, we will here give a brief outline of the embryological and theoretical sections.

The eggs of *Callidina rosseola* and *C. lutea* may be found by shaking out moistened roof-moss and examining the dust with a lens, or better, by placing a number of the ripe females in small glasses where the eggs are less liable to be rendered opaque by the adherence of foreign bodies to their sticky surface.

As the egg is large, elongated and requires 17 days to develop, it furnishes an unusually good chance to study the cleavage at leisure, there being moreover resting periods of long duration. From the author's account of the continued rearrangement and shifting of blastomeres within the egg membrane these eggs would seem also to be favorable objects for investigating the relationship of cleavage planes and cell arrangements to mechanical pressure and spacial necessities.

The polar body is exceedingly large (only in some cases were two present) and is formed on what proves to be the dorsal surface near the anterior pole, so from this early stage all the planes of the adult are oriented by this appearance at the end of one side of the elongated egg.

Of the first two cells the larger, I, takes the anterior pole, the smaller, A, posterior; both divide. The first progeny of I form a series of cells on the right side, the progeny of A are arranged on the dorsal and left side. Other cells are budded off from I and form a ventral series. Thus an elongated, solid mass of four rows of cells arise, having the large remnant of I at its anterior end, 16 cells in all.

An increase in the number of cells is accompanied by their moving forward over the remnant of I which now sinks into the interior and furnishes the cells of the entoderm: this being a solid gastrula stage. A few smaller, granular cells, likewise overgrown at the same end of the egg come to lie beneath the ectoderm and are regarded as furnishing the material for the pharynx and salivary gland.

[1] Carl Zelinka: Studien über Räderthiere Zeit. f. wis. Zool. liii, Nov. 1891.

Of the subsequent fate of the embryo to the time of its hatching in the adult form we can only note from the detailed organogeny given by the author the facts that the reproductive organs arise from two small sets of cells given off from the progeny of I, that is from the entoderm: that the nervous system and muscles both come direct from the ectoderm, the former as solid ingrowths, the latter as sinking in of separate cells, muscle cells. The excretory tubes arise from cells of undetermined origin. The flame cells are from the first blind tubes, closed by a protoplasmic mass bearing the numerous cilia.

The author also takes up, in less detail, the embryology of *Melicerta ringens,* a less favorable subject. Here also the precaution was taken to keep the observed embryos up to hatching to avoid the vitiation of results by study of abnormalities.

The cleavage is remarkably similar to that of Callidina. Yet the polar body is found towards the posterior, dorsal end.

Both male and female eggs have the same cleavage and subsequent development in spite of difference of size.

In the author's interpretation of the embryology of Rotifers there is no mesoderm, no middle layer. The sexual organs arise from the entoderm, the cœlon, muscles, pharynx and salivary gland from certain granular ectoderm cells, the circular muscles directly from the adjacent ectoderm and the excretory organs not from the entoderm but probably from the ectoderm. A comparison is thus drawn between the Rotifer and the Trochosphere—the great similarity being overbalanced by the absence of mesoblasts. Thus the Rotifer is to be regarded as an earlier stage than the Trochophore, wanting as yet the special mesoderm mass. The Rotifer is thus not a sexually mature Trochophere. Yet the possession of a subœsophageal ganglia points out a resemblance to the Molluscan trochophore, while there is also much resemblance to an ancestral form for the Polyzoa, Brachiopods and Chætognaths.

The "foot" of the Rotifer is not a ventral organ but to be regarded as a tail or posterior end of the body, having at first a terminal anus afterwards moved dorsally by the formation of a terminal adhesive gland. The embryology of this region is accepted by the author as homologous with that of the abdomen of Crustacea.

While the Rotifers thus stand as representatives of the ancestors of so many groups they themselves are to be divided, as the embryology indicates, from the "Protrochophora" of the Platyhelminthes.

Development of the Renal Organs of Amphibia.—In the Bulletin of the Museum of Comparative Zoology at Harvard College,[1] Mr. Herbert H. Field has published a paper on "the development of the pronephros and segmental duct of Amphibia. The early stage were rendered both in the Urodeles (Amblystoma) and Anurans (Rana, Bufo). The paper consists of one hundred and forty pages and is accompanied by eight plates. The descriptive part of the paper includes about the first fifty pages, giving a detailed account of the origin of the pronephros in the three forms.

After an extensive review of the literature the author concludes. "According to the account which at present receives most general acceptance, the pronephros first appears as an outfolding of the somatoplasm in the form of a longitudinal groove; the anterior end of this groove is destined to become the pronephros; the remaining portion is constricted off to form the segmental duct. Since the process of constriction advances from before backwards, stages may be found in which a completed tube is continuous posteriorly with a mere groove of the somatopleure. In the anterior region the groove remains in communication with the body cavity and grows down towards the ventral surface of the embryo in the form of a broad pocket. The slit-like peritoneal opening of this pouch closes throughout the greater part of its length leaving however two or three regions of incomplete closure the fundaments of the nephrotomes."

"In opposition to this view I would maintain; (1) that the first trace of the excretory system consists of a solid proliferation of somatopleure, the pronephric thickening; (2) that the lumen of the system arises secondarily; and (3) that the pronephric tubules do not appear in consequence of the local fusion of the walls of a widely open pouch, but that they are differentiated at an early stage from the hitherto indifferent pronephric thickening."

With respect to the development of the segmental duct the author writes: "As is well known, observers up to a very recent date have been almost unanimous in ascribing a mesodermal origin to this structure. In regards to the details of this process they have been less at one . . . . . According to one view the duct arises as an evagination of somatopleure, its lumen being therefore a detached portion of the body-cavity . . . . My own observations on Amphibia indicate that in this group the duct does not arise as a fold, and I am of the opinion that in both Cyclostomes and Ganoids the evidence that the duct arises as evagination is at present unsatisfactory . . . A second view of the

[1] Vol. xxi., No. 5, June, 1891.

origin of the duct is that it arises from a solid proliferation of somatopleure . . . In so far as these authors maintain that the duct arises from a solid profileration of mesoderm and acquires its lumen secondarily I entirely agree with them; but my own observations on this point lead me to conclude further that the duct arises throughout its entire length from a continous thickening of somatopleure and that the only free growth which occurs in the Amphibia studied by me is for the purpose of effecting a union with the cloaca.

"Finally it remains for me to consider the third view, that of the ectodermal origin of the duct, which is to-day advocated on so many sides . . . In my opinion the entire excretory system of the forms I have studied unquestionably develops without any participation of the ectoderm in its formation. The duct develops from mesoderm throughout its entire length and at its posterior end, in Rana and Bufo at least, comes in contact with one of the endodermal coruna of the midgut so that nowhere in its development does it come into organic union with the outer germ layer."

An intimate fusion in several processes between the duct and the ectoderm has been described but this fusion the author concludes is secondary and meaningless (?)

The remaining part of the paper deals with "those inferences of a general nature" drawn from a study of the pronephros.

"I conclude therefore that pronephros and mesonephros are parts of one ancestral organ; that the glomeruli are strictly homodynamous with the glomus; that the entire tubular portion of the pronephros is represented in the mesonephros; that the cavity of a Malphigan capsule and the nephrostomal canal connecting it with the body cavity are detached portions of the cœlom, the equivalents of which are not thus differentiated in the pronephros; that the pronephros is developed as a larval excretory organ; and that the period at which it appears largely accounts for its peculiarities of structure."

The closing sections are devoted to a consideration of the evidence which the development of the excretory system throws on the origin of the vertebrates. On the whole, the evidence brought forward does not add materially to the solution of the ancestry of the vertebrates and such a theory can only be established by investigations which shall include in their scope the entire organization of the two groups.

ARCHEOLOGY AND ETHNOLOGY.[1]

The International Congress of Anthropology and Prehistoric Archeology of Paris of 1889.—(*Continued from page* 1034, vol. xxv.)

Miscellaneous Contributions.

1. *Anthropological Studies in Japan.*—M. Shogoro Tsuboi, of the University of Tokio, made a report on this subject. He recalled the numerous works of strangers published upon Japanese anthropology and expressed regret that the writings of his compatriots were almost unknown outside of Japan. He mentioned the great osteological collection of the Medical College of the University, and its special laboratory. He enumerated the results obtained, statistics, photographs of ethnic types, simple or composite, studies in criminology, etc. Japanese ethnography and that of the Ainos particularly had been studied, and archaeological excavations had been followed with care from one to the other of the Empire, in the tumuli, shell-heaps, caverns, etc. The College of Sciences and the Museum of Tokio have been enriched with the result of these excavations, and there has been founded on the initiation of the author an Anthropological Society at Tokio. It has made its first exhibition in the Anthropological Section of the French Exposition.

2. *The Caverns of Central America.*—The prehistoric, or, at least, pre-Columbian monuments of Mexico and Central America have been studied and are tolerably well-known, and this much has been contributed to our knowledge of prehistoric man in that country. But it is not so with the caverns, for while they in many cases bear traces and contain evidences of human occupation in ancient times, they are for the most part unexplored.

M. Desire Pector, Consul of Nicaragua at Paris, himself an ardent prehistoric archaeologist, who was in charge of the Nicaraguan Building and display at the French Exposition, and was Secretary of the International Congress of Americanists, session of 1890, at Paris, presented a list of these, the most interesting of these caverns. He made elaborate and satisfactory descriptions, which must, however, all be omitted, and I must be content with a mere list.

a. Mexico.—The seven legendary caverns of Chicomoztoc.

[1] Edited by Thomas Wilson, Smithsonian Institution.

b. Guatemala.—The Cueva Encantada de Mixco. Described by Fuentes y Guzman in the year 1700. Its length was three leagues. It served the aborigines as a place of adoration and sacrifice in honor of the Divinity of the Fountain, Cateya, Mother of the Water or Goddess of the Water. The grottoes in the neighborhood of Mitla on Mictlan, of which the most celebrated were those of Tibulca and Penol.

c. Salvador.—Cavern near the village of Aguacayo and of the Rio Lempa. It is deep. The Cavern of Corinto. The Cueva y fuente de Sangre, near Amatillo, on the frontier of Honduras.

d. Nicaragua.—The Cavern of Metapa in the Dept. of Matagalpa.

e. Costa-Rica.—There are several caverns in the Province of Guanacaste or Liberia.

f. Venezuela.—One should not neglect the famous Caverns of the Orinoco; Cerro de Luno, Ipi Iboto and Cucurital, the antiquities of which with skulls of the aborigines, deformed and natural, have been recently found by Crevaux and Dr. Marcano.

The grand Cordilleras which cover Central America ought to contain many grottes on the flanks of the mountains. They have never been, or very slightly explored.

3. *The Cup Markings of Espiaux.*—Monsieur Julien Sacaze, of Saint Gaudens, who lately met with a premature death, communicated the Congress a note on the cup-markings of Espiaux near Bagneres-de-Luchon, Pyrenees. He gave a description. There were three series of these. The Calhande Pourics, the alignments of Peyrelade and of Couseillat. He gave a description of these stones, which while of granite boulders within reach of the glaciers of the Os and bearing marks of glacial action, yet had undoubtedly been placed in their present position by human intervention, and so were monuments of human art. Cavities of greater or less size and depth had been wrought in their surfaces, which were to be counted by the hundreds. These were cupstones, and were quite prehistoric, no person having within historic times had any knowledge of their origin or purpose. M. Sacaze believed these sculptures to be contemporaneous with the monuments which they ornament. The stones might have been sepulchral monuments and their ornamentation may have had reference to the cult of the dead.

This paper was exceedingly interesting to me, for I had visited this mountain of Espiaux, the alignments of Peyrelade, and had seen numbers of these cupstones. The cups were usually marked upon the face of the granite boulder.

M. Reber, of Geneva, gave as the latest archeological news from this country the discovery of five hundred cup markings on the rocks of Planet at Salvan in Valais. They were associated with other marks, ovals, triangles and rainures.

Cup markings had been found on the dolmen tombs of Douvaine in Savoy.

4. *Presentation of North American Indians Before the Congress.*—Dr. Topinard presented a band of twenty-five Indians who belonged to the troop of the Wild West under Buffalo Bill, then exhibiting in Paris. The Indians were mostly Ogallalla Sioux ; one or two were Cheyennes. At the request of their commander they gave to the Congress a representation of the gesture speech which has been studied and described by Colonel Garrick Mallory. Mr. T. Wilson acted as interpreter, while Drs. Hamy, Laneau, Topinard, Mortilet and others asked questions and noted peculiarities in the Indianphysiognomy, their customs and equipments, while Mr. Kunz exhibited a collection of their ornaments.

When Will the Earth be Entirely Peopled?—In order to answer this question M. Ravenstein has undertaken a series of researches and calculations the results of which are published in the Proceedings of the London Geographical Society, 491, p. 27.

It appears from this work that the population of the globe, 1,467,000,000 of people, is distributed over the surface of the islands and continents, excluding the polar regions, in the proportion of thirty-one inhabitants to the English square mile (2.59 kilometres). The author divides the entire land surface, 46,350,000 square miles, into three regions ; fertile lands, steppes, and deserts, which contain respectively, in round numbers, 28,000,000, 14,000,000, and 4,000,000 of square miles. He computes the maximum number of inhabitants which each of these regions can sustain per square mile as follows: fertile lands, 207 ; steppes, 10 ; and desert, 1. The average for India is 175, for China 295, for Japan 264. M. Ravenstein estimates the maximum of inhabitants that can be sustained on the entire land surface at 5,994,000,000.

At what date will this fatal number be reached? The increase of population in the different countries can be expressed, according to the author, by the following figures :

Europe	8.7	per cent. by decade
Asia	6	" " " "
Africa	10	" " " "
Australia and Oceanica	30	" " " "
North America	20	" " " "
South America	15	" " " "
Total	8	per cent. by decade

With this ratio of increase as a basis, the figure 5,994,000,000 will be attained A. D. 2072, or in about 181 years.

It is a curious fact that this is very nearly the same date when, according to the geologists, the coal supply of Great Britain, which gives her prestige among nations, will be exhausted.

Our great-grandchildren will have reason to reflect upon the future and the fate of their posterity doomed to struggle for life under the hard conditions that may be summarized in these words: want of combustibles and room upon the face of the earth. (L'Anthropologie, Tome II, No. 6, p. 753.)

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Association of American Anatomists.—The fourth annual session was held September 23 to 25, 1891, at Washington, D. C. The officers for 1890–'91 were: Joseph Leidy, M. D., LL.D. (deceased), Philadelphia, Pa., President; Frank Baker, M. D., Washington, D. C., 1st Vice President and Acting President; Faneuil D. Weisse, M. D., New York City, 2d Vice President; D. S. Lamb, M. D., Washington, D. C., Secretary and Treasurer. EXECUTIVE COMMITTEE: Harrison Allen, M. D., Philadelphia, Pa.; Burt G. Wilder, M. D., Cornell University; Thomas Dwight, M. D., LL.D., Harvard University, President and Secretary, ex-officio; Mr. Fred. A. Lucas, of Washington, D. C., Delegate to the Congress; D. K. Shute, M. D., of Washington, D. C., Alternate.

Wednesday, September 23.—1. Opening of the session by the Acting President. 2. Report of Executive Committee. 3. Report of Secretary and Treasurer. 4. Election of new members. 5. Report of Committee on anatomical Nomenclature. 6. Proposed amendment to Constitution abolishing dues and substituting assessments. DR. ALLEN. 7. Proposed amendment to Constitution providing for Honorary Memberships, to apply more especially to foreign anatomists. DR. LAMB.

8. Miscellaneous business. 9. Resolutions and remarks upon the death of DR. LEIDY. Papers Read.—1. The fundamental principles of anatomical nomenclature. DR. BURT G. WILDER, Cornell University. 2. The systematic use of the eye in teaching anatomy. Accompanied by a demonstration of a brain model. DR. WM. P. CARR, Washington, D. C. 3. Some impressions on the teaching of anatomy to medical students. DR. HARRISON ALLEN, Philadelphia, Pa. [Discussion opened by DR. DWIGHT, followed by DR. BAKER.] 4. The fossa prænasalis. DR. THOMAS DWIGHT, Harvard University. 5. Notes on the hearts of certain animals. IDA HYDE, Chicago, Ill. [Read by DR. S. V. CLEVENGER, Chicago, Ill.]

The members of the Association and their families were invited by the Acting President, Dr. Frank Baker, to visit, after the Wednesday morning session, the National Zoological Park.

Thursday, September 24.—Miscellaneous Business: Papers read. 6. Recent fissural diagrams. DR. BURT G. WILDER, Cornell University. 7. The arrangement of the supracerebral veins in man, as bearing on Hill's theory of developmental rotation of the brain. DR. WM. BROWNING, Brooklyn, N. Y. 8. Morphological importance of the membranous or other thin portions of the parietes of the encephalic cavities. DR. BURT G. WILDER, Cornell University. 9. The alleged lateral orifices, communications of the fourth ventrical with the subarachnoid space. Are they natural? DR. BURT G. WILDER, Cornell University. [Being a reply to part of DR. F. W. LANGDON's paper, "Homology of cerebro-spinal arachnoid with the other serous membranes." Read at the Boston meeting in 1890. Published in Medical Record Aug. 15, 1891, p. 177.] 10. The structure of basis and cement substance. DR. CHARLES HEITZMANN, New York City. 11. Serial fœtal sections. Specimens and remarks. DR. W. W. GRAY, Washington, D. C. 12. The teeth of the Chiroptera. DR. HARRISON ALLEN, Philadelphia, Pa. 13. Specimens of supernumerary digits in man and the pig. DR. F. J. SHEPHERD, Montreal. 14. The relative frequency of the psoas parvus muscle in the colored race. DR. E. A. BALLOCH, Washington, D. C. 15. Certain modifications in plant morphology, produced by external conditions. DR. W. P. WILSON, Philadelphia, Pa. 16. Comparative osteology of the North American Pygopodes. DR. R. W. SHUFELDT, Washington, D. C. 17. The supracondyloid process in man. DR. D. S. LAMB, Washington, D. C. 18. Platycnemic tibias. DR. FRANK BAKER, Washington, D. C. 19. History of anatomy as a science. DR. G. W. WEST, Washington, D. C. 20. Congenital union of the quadrate jugal to the mandible in a

cockatoo. Specimens and remarks. Mr. Fred. A. Lucas, Washington, D. C. 21. Homologies of the principal bones. Mr. Fred. A. Lucas, Washington, D. C. Friday, September 22. 1. Election of officers for 1891–93. Election of Delegate and Alternate to the Congress. Election of one member of Executive Committee. 4. Miscellaneous business.

Natural Science Association, of Staten Island.—*January* 9th, 1892.—The following paper, illustrated by maps and specimens, was read by Mr. Arthur Hollick:

On the 4th of April, 1881, Dr. N. L. Britton read a paper before the New York Academy of Sciences on the geology of Richmond County. This paper was published in the Annals of the Academy, vol. ii, No. 6, and in it the prediction was made that Cretaceous clays would be found beneath the drift to the South and East of the Archæan Ridge wherever this covering of the drift might be removed. At that time Dr. Britton used the following words: "No fossil leaves or shells have been taken from the clay of Staten Island, but it is not improbable that they will be found at some future time, when the excavations are more advanced than at present. They are. more likely to be found in buff or dark colored clays than in fire clay."

All subsequent geologists followed on the same lines, and on all geological maps of this vicinity the existence of Cretaceous strata on the south side of the Island is indicated. The actual knowledge upon which this assumption was based was, however, very fragmentary and unsatisfactory. The only known exposures of Cretaceous clay were at Kreischerville and in a ravine at Princes Bay, and how far these extended was not known. Nevertheless, every observant geologist knew what ought to be, and took it for granted that Dr. Britton's conclusions were correct.

Definite evidence in regard to the subject has been slowly accumulating, and especially during the past three months, important facts have come to light. Some of these facts were recorded by me at the time of discovery in our Proceedings. Others have never been placed on record. Following is a brief review of their sequence:

In June, 1883, a single cast of a large shell was found by Mr. W. T. Davis on the surface of a sandy field at Tottenville. It was identified by Prof. R. P. Whitfield, of the American Museum of Natural History, as *Pachycardium burlingtonense* Whitfield; but its significance was not realized by us, and it was regarded as most likely to be an accidental estray.

In November of the same year I picked up on the shore at Tottenville a few blocks or concretions of ferruginous sandstone, containing fragments of vegetable remains, evidently similar to specimens previously found at Keyport, N. J., and Glen Cove, Long Island. The identity of these was at once noted by Dr. Britton, and they were declared, almost with certainty, to be of Cretaceous age. (See Proceedings, Nov. 10 and Dec. 8, 1883.)

In November, 1885, fossil vegetable remains were found in one of the clay beds at Kreischerville. They were too fragmentary for determination, but were apparently identical with similar remains from the Amboy clays. (See Proceedings, Dec. 12, 1885, and Feb. 13, 1886.)

During the Autumn of 1888 a single fossil leaf was found by Mr. Gilman S. Stanton in a block of ferruginous sandstone at Arrochar, which fortunately came to my attention and was kindly turned over to me. As in the case of the *Pachycardium* found at Tottenville, however, its importance was not realized at the time, and the opinion was expressed by me that it was probably of Drift origin. (See Proceedings, Dec. 8, 1888.)

Outcrops of what was apparently Cretaceous clay and gravel were next discovered on the shore and in the ravine at Princes Bay, on the shore at Eltingville, and in a gravel pit on the North side of the Fingerboard road at Clifton. (See Proceedings, March 14, April 11, May 9, and Oct. 10, 1889.)

In the meantime the material from Tottenville was accumulating, some of the specimens being in far better condition than those at first discovered, so that they could be accurately studied and the species of plants determined, leaving no question as to their Cretaceous age. All the organic remains thus far found were vegetable; no animal remains having been even indicated, if we except the single *Pachycardium* previously mentioned.

On May 1, 1889, Dr. N. L. Britton and myself were exploring the clay beds along the Raritan River, at Perth Amboy, where we found ferruginous sandstones and concretions containing molluscs, but in all other respects identical with the leaf-bearing concretions from the shore at Tottenville. This encouraged us to believe that careful search on Staten Island would probably yield similar results, and such has been the case.

In October, 1891, I found molluscs in the concretions at Tottenville, and immediately afterwards at Arrochar. These and the ones from Perth Amboy were submitted to Prof. Whitfield and by him identified as Cretaceous species.

Finally, in November, 1891, I found well preserved fossil leaves of undoubted Cretaceous species on the shore at Princes Bay, in concretions in all respects similar to those from Amboy, Tottenville and Arrochar.

Following is a list of the molluscs, as far as they have been identified:

Corbula sp? (possibly a new species) Perth Amboy.

Terebratella vanuxemi Lyell and Forbes, Tottenville.

Pachycardium burlingtonense Whitfield, Tottenville.

Cardium (*Criocardium*) *dumosum* Conrad, Arrochar.

Ostrea plumosa Morton, (?) Arrochar.

Aphrodina tippana Conrad, or *Callista delawarensis* Gabb, Arrochar.

Gryphœa sp. ? Arrochar.

In addition to the above there are several species which are not in a sufficiently good state of preservation for determination. Of the vegetable remains the commonest species is *Liriodendron simplex*, Newb. *Protœoides daphnogenoides* Heer, *Eucalyptus genitzi* Heer, and other characteristic Cretaceous plants are represented, besides a number more, among which there may prove to be undescribed species. This material will be the subject of further study.

With the foregoing facts in our possession we are now in a position to feel reasonably sure that the prediction of the existence of Cretaceous strata beneath the Drift in the towns of Westfield and Southfield has been verified, but other points of interest yet remain to be discussed. The first of these is in regard to the character of the rock in which the organic remains are found. Its concretionary nature is apparent—the nucleus in all cases having been a mass of clay in which is enclosed the mollusc or leaf, as the case may be. Limonite often forms as a succession of layers over the outside and the clay is gradually transformed into a hard clay iron-stone. A large series of specimens collected show every stage in the process of formation, from soft clay to hard rock. In the softer material some of the carbon of the vegetation may yet be seen, but in the hard rock nothing except the impressions of leaf or stem remains. Finally, the question will naturally be asked, are these fossils in place where found? Some doubt was felt in regard to the specimens from Tottenville and Princes Bay, inasmuch as they were evidently washed out of the banks, the mass of which is composed of Drift material, in places enclosing considerable clay and yellow gravel. This is conspiciously the case at Princes Bay, as noted by Dr. N. L. Britton in the Proceedings of

November 8, 1884, and a deep talus, extending to the beach sands, has nearly always covered the base of these bluffs, so that the character of the material at the shore level could not be ascertained. Recent excavations at Arrochar have greatly helped in the solution of the problem, however, and I was fortunate in arriving there when a section was freshly exposed. This section showed at its base a bed of sandy micaceous clay, containing the characteristic ferruginous concretions, lying flat in the plane of the bedding. The next member was a bed of yellow sand and gravel, also containing concretions. The concretions containing the specimens of *Cardium dumosum* were dug by me out of these layers of clay and sand, and in the gravel I found silicified corals, so characteristic of the yellow gravel which overlies the Cretaceous clays in New Jersey. Above these beds, and conformable with them, there is about four feet of modified drift, the entire series dipping at an angle of about forty degrees towards the N. W. Bowlder drift covers the surface. That these beds have been subjected to considerable disturbance is evident from the position in which we now find them, and the stratigraphy of the subject would be an interesting matter for future investigations. It is highly probable that these isolated and limited exposures represent a large and probably continuous bed of Cretaceous strata underlying the entire region, as previously predicted.

Boston Society of Natural History.—November 18th.—The following papers were read: Dr. George Baur, A Visit to the Galapagos Islands; Prof. W. M. Davis, The Catskill Delta in the post-glacial Hudson Estuary.

December 2d.—The following papers were read: Prof. A. Hyatt, Relations of Ancient and Modern Pinnas; Dr. C. S. Minot, Recent Investigations on the Brain.

A general meeting was held in commemoration of late officers of the Society, Wednesday evening, December 16th, at 7.45 o'clock.—The following communications were made: Dr. J. C. White, Sketch of the Life of D. Humphreys Storer; Mr. Samuel Garman, Dr. Storer's Work on Fishes; Mr. S. H. Scudder, The Services of Edward Burgess to Natural Science; Dr. B. Joy Jeffries, Mr. Burgess' application of Science in naval Architecture, illustrated by stereopticon views of yachts and the international races; Profs. G. L. Goodale, C. S. Minot, and N. S. Shaler, In Memory of Samuel Dexter.

January 6th.—The following papers were read: Mr. Percival Lowell, Shinto Occultism from a Scientific Standpoint; Prof. E. S. Morse, On the Form of the Ancient Bow in Various Parts of the World.

January 20th.—The following papers were read: Dr. Charles V. Riley, Life History of Sphecius speciosus, Drury; Notes on Caprification; Mr. S. H. Scudder, The Tertiary Weevils of North America.

Biological Society of Washington.—November 28.—The following communications were read: Dr. George Marx, On the Structure and Construction of the Geometric Spider Web; Mr. Charles D. White, Some Peculiar Forms in an Upland Carboniferous Flora; Prof. F. H. Knowlton, Fruiting Ferns from the Laramie Group; Mr. Frederick V. Coville, Review of Kuntze's Revisio Generum Plantarum; Dr. C. W. Stiles, Notes on Parasites—*Spiroptera scutata.*

December 12th.—The following communications were read: Mr. Frederick V. Coville, Review of Kuntze's Revisio Generum Plantarum; Mr. E. M. Hasbrouck, Remarks on Dichromatism; Prof. Lester F. Ward, Recent Discoveries of Potomac Fossil Plants near Washington.

December 26th.—The following communications were read: Prof. E. H. Knowlton, A Fossil Bread Fruit Tree from the Sierras of California; Prof Lester F. Ward, Alphonse de Candolle on the Transmission of acquired Characters; Prof. B. T. Galloway, A New Pine Disease; Dr. C. Hart Merriam, Remarks on the Affinities of the North American Squirrels, Chipmunks, Spermophiles, Prairie Dogs and Marmots.

January 23d.—The following communications were read: Dr. C. W. Stiles, Notes on Parasites; *Myzonimus* gen. nov.; Mr. Theo. Holm, Studies of the Morphological Identity of the Stamens; Dr. Theobald Smith, On Peculiar Forms of Red Corpuscles in Mammalia in Anæmic Conditions.—Frederic A. Lucas, *Secretary.*